中国核科技报告

CHINA NUCLEAR SCIENCE AND TECHNOLOGY REPORT

文　　摘

ABSTRACTS
1998

CNIC-01390

中国核科技报告文摘

（1998 年）

ABSTRACTS
CHINA NUCLEAR SCIENCE &
TECHNOLOGY REPORT (1998)

摘　　要

　　本期《文摘》包括 1998 年度出版的《中国核科技报告》（报告号 CNIC－01231～CNIC－01330）各篇的题录和摘要，款目技国际核情报系统（INIS）的类目进行编排。六大类目依次为：物理科学；化学、材料与地球科学；生命科学；同位素、同位素应用与辐射应用；工程与技术；核能其他问题。每篇款目的左上角的编号是报告号，右上角的编号是款目顺序号。最后附有 1998 年度出版的报告的号码索引。

ABSTRACT

　　The bibliographies and abstracts of China Nuclear Science and Technology Reports published in 1998 (Report Numbers CNIC-01231～CNIC-01330) are presented. The items are arranged according to INIS subject categories, which mainly are physical sciences, chemistry, materials, earth sciences, life sciences, isotopes, isotope and radiation applications, engineering and technology, and other aspects of nuclear energy. The numbers on the left corners of the entries are report numbers, and on the right corners the serial numbers. A report number index is annexed.

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A00.00 物理科学 PHYSICAL SCIENCES

A10.00 普通物理学 GENERAL PHYSICS

A11.00 数学物理与普通理论物理学 Mathematical and General theoretical Physics

光子输运的数值并行计算/黄清南, 梁晓光, 张利发 (中国工程物理研究院, 成都, 610003)

阐述光子输运问题的并行计算, 探讨适合于共享存储体系结构并行机和分布存储体系结构并行机的并行算法及程序并行化技术。通过对光子输运数学物理模型内在规律的剖析, 并针对并行机的结构特点, 运用"分而治之"策略, 调整程序算法结构, 分解数据相关性, 发掘并行 (向量) 化潜力, 创建大粒度并行子任务, 将光子输运的串行计算有效地转化成既可向量化又可并行化的并行计算。并且先后在 YH-1 机(PVP)、Challenge 机 (SMP) 和 YH-3 机 (MPP) 等不同类型的高性能并行机上进行数值模拟计算, 取得了很好的并行 (向量) 加速比。

The Numerical Parallel Computing of Photon Transport/HUANG Qingnan, LIANG Xiaoguang, ZHANG Lifa (China Academy of Engineering Physics, Chengdu, 610003) (*In Chinese*)

The parallel computing of photon transport is investigated; the parallel algorithm and the parallelization of programs on parallel computers both with shared memory and with distributed memory are discussed. By analyzing the inherent law of the mathematics and physics model of photon transport according to the structure feature of parallel computers, using the strategy of "to divide and conquer", adjusting the algorithm structure of the program, dissolving the data relationship, finding parallel liahle ingredients and creating large grain parallel subtasks, the sequential computing of photon transport is efficiently transformed into parallel and vector computing. The program was run on various HP parallel computers such as the YH-1 (PVP), the Challenge (SMP) and the YH-3 (MPP) and very good parallel speed up has been gotten.

A12.00 原子与分子物理学 Atomic and Molecular Physics

UO 分子基态 $X^3\Sigma$ 和激发态 $^1\Sigma^+$ 的量子力学计算/王红艳, 高涛, 易有根, 谭明亮, 朱正和 (四川联合大学原子分子工程研究所, 成都, 610065); 傅依备, 孙颖, 汪小琳, 刘晓亚 (西南核物理与化学研究所, 成都, 610003)

基于群论和量子力学计算, 导出 UO 气体的两个电子状态, 即基态为 $^3\Sigma$ 和激发态为 $^1\Sigma^+$, 其平衡核间距和离解能, 对 $^3\Sigma$ 分别为 0.1833 nm 和 6.9241 eV, 对 $^1\Sigma^+$ 分别为 0.1825 nm

和 8.2651 eV。同时，用量子力学的 MP2 方法计算得到势能曲线，由此导出两个电子状态的 Murrell-Sorbie 势能函数，并计算出能量、光谱和热力学性质，UO($X^3\Sigma^-$)的标准生成焓 ΔH_f^0 为 6.331 kJ/mol，标准生成自由焓 ΔG_f^0 为-30.63 kJ/mol。

The Quantum Mechanical Calculation of the Grouud State $X^3\Sigma^-$ and Excited State $^1\Sigma^+$ for UO/WANG Hongyan，GAO Tao，YI Yougen，TAN Mingliang，ZHU Zhenghe (Institute of Atomic and Moleular Physics, Sichuan Union University, Chengdu, 610065)；FU Yibei，SUN Ying，WANG Xiaolin，LIU Xiaoya (Southwest Institute of Nuclear Physics and Chemistry, Chengdu, 610003) (*In Chinese*)

The ground state $X^3\Sigma^-$ and excited state $^1\Sigma^+$ for UO and their reasonable dissociative limits are successfully derived, based on group theory and atomic and molecular reactive statics (AMRS). Using the MP2 (The HF calculation followed by a second-order Moller-Plesset correlation) method of Gaussion 94w and the RECP potential (the relativistic effective core potential) for U and basis 6-311G for O, the full potential energy curves for the ground state $X^3\Sigma^-$ and excited state $^1\Sigma^+$ of UO have been calculated, respectively, of which the equilibrium nuclear distance and dissociation energy are 0.1833 nm and 6.9241 eV for the $X^3\Sigma^-$ state, and 0.1825 nm and 8.2651 eV for the $^1\Sigma^+$ state. From their Murrell-Sorbie function, the complete spectroscopic data and thermodynamic data are also derived for the first time. The standard enthalpies of formation of UO is 6.331 kJ/mol, and the standard Gibbs free energy of formation is -30.63 kJ/mol.

CNIC-01277；SUINST-0019   980003

ThO 分子基态 $X^1\Sigma^+$ 和激发态 $H^3\Delta$ 的量子力学计算/高涛，王红艳，易有根，冉鸣，蒋刚，朱止和 (四川联合大学(西区)原子分子工程所，成都，610065)；傅依备，孙颖，唐永建，汪小琳 (西南核物理与化学研究所，成都，610003)

用全相对论量子力学理论计算得到 Th 的 27 个能级和电子状态，用原子分子反应静力学原理推导出 ThO 的一系列的可能电子状态并证明了基态 $X^1\Sigma^+$ 和激发态 $H^3\Delta$ 的离解极限，在考虑相对论有效原子实势 (RECP) 近似下，用 G94W 程序的 CISD 方法计算得到了 ThO 分子基态 $X^1\Sigma^+$ 和激发态 $H^3\Delta$ 的 Murrell-Sorbie 解析势能函数及其对应的平衡几何与光谱参数，结果与实验数据符合得比较好。热力学函数的计算结果也与实验符合得较好。这表明 RECP 近似用于锕系元素化合物的量子力学计算是一种可行方法。

Quantum Mechanical Calculation On the Electronic States $X^1\Sigma^+$ and $H^3\Delta$ of ThO/GAO Tao，WANG Hongyan，YI Yougen，RAN Ming，JIANG Gang，ZHU Zhenghe (Insititute of Atomic and Molecular Physics, Schuan Union University, Chengdu, 610065)；FU Yibei，SUN Ying，TANG Yongjian，WANG Xiaolin (Southwestern Insititute of Nuclear Physics and Chemistry, Chengdu, 610003) (*In*

Using the full relativistic quantum mechanics (GRASP II), all the 27 electronic states of Th consisting of the electronic configurations [Rn] $6d^27s^2$, [Rn] $6d^37s^1$ and [Rn] $6d^4$ have been calculated. The ground states [CSF] of Th is $^3F_2$. Based on the theory of atomic and molecular reactive statics (AMRS), the ground state $X^1\Sigma^+$ and excited state $H^3\Delta$ for ThO and their reasonable dissociative limits are successfully derived. Using the CISD method (Configuration Interaction with Single and Double Substitutions) of Gaussian 94 and the RECP (relativistic effective core potential) for Th and basis 6-311g for O, the full potential energy curves for $X^1\Sigma^+$ and $H^3\Delta$ of ThO has been calculated from which the Murrell-Sorbie function and the corresponding spectroscopic data are derived for the first time, which are in good agreement with experiments. In addition, the standard formation ΔH^0, ΔS^0 and ΔG^0 for the $X^1\Sigma^+$ of ThO at 1 atm and 298 K are also found out. It is revealed that the RECP method for atom and molecule of actinide is an effective way to calculate the actnide compounds.

A13.00 固体与流体物理学 Solid state and Fluid Physics

CNIC-01251; SIP-0103 980004

二维流速分布引起的 **MHD** 压降效应/许增裕，潘传杰，魏文浩（核工业西南物理研究院，成都）

磁流体动力学流体在管道截面上的流速分布关系到材料的相容性、传热以及磁流体动力学（MHD）压降。为此研究了矩形管道截面中心线上的流速分布和由于二维流速分布引起的 MHD 压降效应。在这一领域，首次得出的二维效应因子，解释了目前的理论值为什么比实验值低的原因。

MHD Pressure Drop Effect Due to Two Dimensional Velocity Distribution/XU Zengyu, PAN Chuanjie, WEI Wenhao (Southwestern Institute of Physics, Chengdu)

It is important that Magneto-hydro-dynamic (MHD) flow velocity distribution in cross section of duct are related to materials compatibility, heat transfer and MHD pressure drop. The experimental results of velocity distribution across rectangular duct on the center plane, and of two-dimensional (2D) MHD pressure drop effect due to 2D-velocity distribution are presented. The results showed that the boundaries and core velocity distribution on the center plane of the duct are increasing with Hartmann number M increasing, but the approach theory expected that core velocity distribution is decreasing with M increasing. The 2D effect factor for MHD pressure

drop from the 2D-velocity distribution was also carried out. This explained the reason why numerical results of MHD pressure drop gradient are lower than that of experiments.

CNIC-01315; CAEP-0004   980005

二维自适应数值网格的构造方法及其实现/徐涛，水鸿寿（中国工程物理研究院，成都，610003）

讨论了一种二维自适应网格的构造方法，并具体地给出了它的实施过程。指出当控制函数连续给出时，方法是有效和便于实现的，给出了一些区域的网格构造图；实际计算中自适应网格控制量的数值解一般是离散给出的，这时为了形成连续的控制函数，需要对离散分布的量做插值，才能进行网格构造。文中讨论了这个过程中所遇到的具体问题和解决方法，并在一种二维插值法的基础上做出了自适应网格。最后利用自适应网格技术对一个二维流体力学问题的实例进行了计算。

A Two-dimensional Adaptive Numerical Grids Generation Method and Its Realization/XU Tao, SHUI Hongshou (China Academy of Engineering Physics, Chengdu, 610003) (*In Chinese*)

A two-dimensional adaptive numerical grids generation method and its particular realization is discussed. This method is effective and easy to realize if the control functions are given continuously, and the grids for some regions are showed in this case. For Computational Fluid Dynamics, because the control values of adaptive grids-numerical solution are given in dispersed form, it is needed to interpolate these values to get the continuous control functions. These interpolation techniques are discussed, and some efficient adaptive grids are given. A two-dimensional fluid dynamics example was also given.

A14.00 等离子体物理学与热核反应　Plasma Physics and Thermonuclear Reactions

CNIC-01254; SIP-0104   980006

从低杂波电子相互作用到低杂波离子相互作用的转折密度/薛思文，刘永，李晓东，王恩耀，丘孝明（核工业西南物理研究院，成都，610041）

在 HL-1M 托卡马克上，当等离子体密度大于 4×10^{13} cm^{-3} 时，成功地进行了可重复的低杂波离子加热实验。提出了一个基于离子朗道阻尼的模型来解释这些实验结果。主要考虑了波在等离子体中加热离子的垂直于环向磁场的电场远大于加热电子的平行于环向磁场的电场。在假定低杂波波谱上移后，由所提出的模型得到的从低杂波电子相互作用到低杂波离子相互作用的转折密度不但与 HL-1M 上的实验结果相符合，也与其它托卡马克的实验结果相符合。计算结果表明转折密度随电子离子温度比的变化非常敏感。

The Switchover Density from Electron-Interaction to Ion-LHW interaction/XUE Siwen, LIU Yong, LI Xiaodong, WANG Enyao, QIU Xiaoming

(Southwestern Institute of Physics, Chengdu, 610041)

The reproducible Lower Hybrid Wave (LHW) ion heating in the HL-1M tokamak has been successfully carried out at plasma densities higher than 4×10^{13} cm^{-3}. A model based on the ion Landau damping, is proposed to explain the experimental results. It has been taken into account that the electrical field, perpendicular to the toroidal magnetic field, of wave in plasma is much higher than the parallel one. Along with the assumption of $n_{//}$ upshifting of launched LHW spectrum, the switchover density obtained is in good agreement with experimental results of LHW ion heating performed in HL-1M as well as other tokamaks. The computational results reveal that the switchover density is very sensitive to the ratio of T_e to T_i.

HL-1M 弹丸注入实验中等离子体的约束改善特征和中心磁流体动力学特性研究/刘仪，郭干城，钟云泽，肖正贵 (核工业西南物理研究院，成都，610041)

在 HL-1M 实验中，多发弹丸注入到欧姆加热放电中，明显改善了等离子体约束特性。与相同条件下的欧姆加热放电相比，能量约束时间提高了约 30%。等离子体约束的改善是因为弹丸注入后在等离子体中心区域形成了高度峰化的密度和压强分布。实验发现弹丸穿透的深度决定了密度和压强分布的峰化程度，而等离子体中心的磁流体力学活性又随着密度和压强分布的峰化程度的增大而改变。另一方面，等离子体中心磁流体动力学 (MHD) 活性在限制可达到的中心等离子体压强和决定中心输运特性上起着重要作用，标志着弹丸注入约束改善的峰化的密度、压强分布在出现第一个大锯齿后平化。随着弹丸穿透的加深，芯部区域的压强 (密度) 梯度变陡，中心 MHD 活性受到弹丸注入的强烈影响，锯齿崩溃特征有在更高密度、更高压强下时才出现的类理想模的特性，并在崩溃过程中 $m=1$ 模的发展与一个非常定域的压强扰动耦合。

Improved Plasma Confinement Characteristics and Central Magnetohydrodynamic Activity in Pellet Fuelled HL-1M Experiment/LIU Yi, GUO Gancheng, ZHONG Yunze, XIAO Zhenggui (Southwestern Institute of Physics, Chengdu, 610041)

In HL-1M experiment, multiple pellets were injected into Ohmic discharge, good results for plasma confinement have been achieved. The energy confinement is enhanced by up to 30% over that of usual gas fuelled discharges after a series of pellet injections. The improvement is characterized by a pressure profile that peaks strongly around the central region. It was found that the peakedness depends strongly on penetration length of the pellets, and the characteristics of MHD activity changes with peakedness of pressure profile produced by pellet injection. On the other hand,

the central MHD activity plays a key role in limiting the available peaking degree. The improved discharges characterized by a highly peaked pressure profile inside $q=1$ surface degrade suddenly by a large sawtooth collapse. For deep penetration case, the pressure gradient in the central area becomes steep, the central magnetohydrodynamic activities are strongly affected by pellet injection. The large sawtooth crash tends to have more ideal-like characteristics in magnetic structure, which is usually observed in discharges of higher density and pressure values. The most conspicuous feature is that just at the early stage of the crash, the $m=1$ continuous oscillation merges into a very localized pressure perturbation.

CNIC-01312; CAEP-0001   980008

在强场中产生相干高次谐波的真空紫外～软 X 射线源的进展评述/孙景文 (中国工程物理研究院，成都，610003)

评述了用不同的激光系统在强场中获得高次谐波的最近进展，研究了激光脉冲宽度、激光波长（从近红外到紫外波段）和原子系统对产生的光子数和得到的最大能量的影响，产生的谐波强烈地与聚焦条件相关。基于不同文献的试验结果，完成了特征谐波分布的讨论，包括宽坪、交流 Stark 效应在坪台形成过程中的作用，基波与产生的谐波的相关性。

A Review on Advance of Coherent High-order Harmonic Generation in Strong Fields for VUV ~ Soft X-rays Source/SUN Jingwen (China Academy of Engineering Physics, Chengdu, 610003) (*In Chinese*)

The recent advances concerning high-order harmonic generation results obtained with different laser systems in strong laser-fields are reviewed. The influence of the laser pulse width, the excitation wavelength (from the near infrared to the ultraviolet) and the atomic systems on the number of photons produced and on the maximum energy attained are investigated. Harmonic generation also depends strongly on the focusing conditions. Based on the experimental results form different references, a discussion is made on the characteristic harmonic distribution including a broad plateau, the role of ac stark effects in the plateau formation, the fundamental-wavelength dependence of barmonic generation.

CNIC-01319; CAEP-0007   980009

壁厚 1 μm 以下薄壁空心玻璃微球制备工艺研究/杜守德，魏胜，师韬 (中国工程物理研究院，成都，610003)

叙述了采用液滴法制备壁厚 1 μm 以下薄壁空心玻璃微球生产工艺。系统地研究了玻璃溶液配方、玻璃溶液浓度、发泡剂的加入量、液滴炉各温区温度、抽气速度等因素的变化对生产空心玻璃球壳壁厚及直径的影响，确定了生产 1 μm 以下超薄壁空心玻璃球壳的

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工艺条件。采用该工艺，首次成功地生产出直径 $\phi150\sim250$ μm，壁厚小于 1 μm 的空心玻璃球壳，微球表面光洁度及同心度都能较好地满足物理实验要求。

Preparative Process for Hollow Glass Microsphere with Wall Thickness under 1 μm/DU Shoude，WEI Sheng，SHI Tao (China Academy of Engineering Physics, Chengdu, 610003) *(In Chinese)*

The process for mass producing the high quality glass microspheres has been developed for ICF in China. The wall thickness of these microspheres is less than one micron. The effect of each zone temperature of drop furnace, flow rate of furnace air, solid concentration in the glass forming solution and concentration of the blowing agent on parameters of glass microspheres such as diameter and wall thickness are systematically studied. Glass microspheres with walls under 1 μm thick and which satisfy the exacting surface and symmetry specifications of targets for Shen-Guang - II directly driven experiments are now produced routinely.

金 M 带谱时空特性研究/李三伟，冯杰，缪文勇，丁永坤，王耀梅，唐道源（中国工程物理研究院，成都，610003）

给出了金 M 带谱细致结构及金 M 带发射的空间尺度和时间尺度。用晶体谱仪配软 X 光条纹相机测得三倍频激光与发泡金盘靶相互作用金 M 带发射的时间尺度是：$E_l = 46$ J，$\tau=571$ ps 时，金 M 带发射持续时间（FWHM）约 850 ps。用狭缝配晶体谱仪测得金 M 带发射的空间尺度是：当 $\lambda=1.06$ μm，$E_L=106$ J，$\tau = 550$ ps 时，金 M 带发射的空间尺度（FWHM）为 57 μm；当 $\lambda=0.35$ μm，$E_L=25\sim38$ J，$\tau = 510$ ps 时，金 M 带发射的空间尺度（FWHM）为 $27\sim37$ μm。

Temporal and Spatial Characters Measurement of Gold M-Band Emission/LI Sanwei，FENG Jie，MIAO Wenyong，DING Yongkun，WANG Yaomei，TANG Daoyuan (China Academy of Engineering Physics, Chengdu, 610003) *(In Chinese)*

Duration of gold M-band emission was measured to be 850 ps by coupling a crystal spectrometer to an X-ray streak camera under laser condition of $\lambda = 0.35$ μm, $E_l = 46$ J, $\tau = 571$ ps. While the dimensions of gold M-band emission were measured to be 57 μ m and $27\sim39$ μ m under laser condition of $\lambda = 1.06$ μm , $E_l= 106$ J, $\tau = 550$ ps and $\lambda= 0.35$ μm , $E_L= 25\sim38$ J, $\tau = 480\sim570$ ps, respectively.

低 Z 材料辐射烧蚀与能量传输研究/杨家敏，丁耀南，缪文勇，孙可煦，易荣清，陈正林，王红斌，李三伟，王耀梅，温树槐，郑志坚，张文海，丁燕宁（中国工程物理研究院，成都，610003）

在星光装置上，对 0.35 μm 波长激光辐照金箔靶产生的 X 光辐射进行了研究。通过选择辐照激光参数，从金箔背侧获得了干净的强 X 光辐射源。以金箔背侧 X 光辐射作为辐射烧蚀源，系统地研究了低 Z 的 C_8H_8，$C_{10}H_{16}O_5$ 和 C_8H_8 发泡样品的辐射烧蚀和能量传输特性。实验结果表明：由于样品材料 $C_{10}H_{16}O_5$ 与烧蚀源能谱匹配较好，$C_{10}H_{16}O_5$ 材料的辐射烧蚀速率和烧蚀深度大于 C_8H_8 的值。

Study of Radiative Ablation to Low-Z Material and Energy Transport/YANG

Jiamin, DING Yaonan, MIAO Wenyong, SUN Kexu, YI Rongqing, CHEN Zhenglin, WANG Hongbin, LI Sanwei, WANG Yaomei, WEN Shuhuai, ZHENG Zhijian, ZHANG Wenhai, YU Yanning (China Academy of Engineering Physics, Chengdu, 610003) (*In Chinese*)

X-ray emissions from the gold foil target, irradiated by 0.35 μm laser on the Xingguang facility, have been studied. A clean and intense X-ray source has been obtained from the rear of gold foil target by selection of irradiating laser parameters. Then, characteristics of radiation ablation to low-Z material C_8H_8 and $C_{10}H_{16}O_5$ and energy transport have been investigated comprehensively. Experimental results show that mass ablative rate of $C_{10}H_{16}O_5$ are greater than those of C_8H_8 due to its better match with the ablative source spectra.

辐射加热不同材料靶的 X 光再发射研究/孙可煦，易荣清，杨家敏，王红斌，黄天喧，祀延莉，陈久森，丁耀南，丁永坤（中国工程物理研究院，成都，610003）

研究辐射加热不同材料再发射 X 光特性。实验利用星光 II 二倍频激光，以 10^{14} W/cm² 激光强度辐照金盘形成辐射加热源，加热不同材料，利用多种诊断设备组合，并采取时、空、谱关联测量，给出辐射加热不同材料的再发射时间延迟，再发射效率，再发射光谱结构以及等离子体碰撞滞后发射的时、空特性。

Experimental Study of X-Ray Reemission from Different Material Target Heated by Radiation/SUN Kexu, YI Rongqing, YANG Jiamin, WANG Hongbin,

HUANG Tianxuan, CUI Yanli, CHEN Jiusen, DING Yaonan, DING Yongkun (China Academy of Engineering Physics, Chengdu, 610003) (*In Chinese*)

Experiments to study the soft X-ray reemission properties from different material heated by the radiation produced by laser plasma are reported. Thermal source is performed with the laser pulse (intensity 10^{14} W/cm²) to act on Au disk target in Xing Guang laser facility, which heated different materials. Temporal, spatial and spectral composition measurement is performed with varied soft X-ray diagnostic facilities. Finally, reemission time delay, reemission efficiency,

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reradiation spectrum construction and delay emission time-space properties of the stagnation plasma are given.

A30.00 中子物理学与核物理学 NEUTRON AND NUCLEAR PHYSICS

A34.00 核性质与核反应 Nuclear Properties and Reactions

天然镍全套中子核数据的评价/马功桂，王世明 (四川联合大学原子核科学技术研究所，成都，610064)

评价了天然镍在 10^{-5} eV～20 MeV 能区的全套中子数据。数据包括全截面、弹性、去弹、总非弹、33 条分立能级和连续态的非弹及 (n, 2n), (n, 3n), (n, n'α)+(n, αn'), (n, n'p)+(n, pn'), (n, p), (n, d), (n, t), (n, α), (n, γ) 和 (n, 2p) 反应截面，还包括有关反应的次级中子角分布、双微分截面(DDCS)，γ产生数据和共振参数。评价依据直到 1996 年测量的实验数据和用 UNF 程序的理论计算。评价数据以 ENDF/B-6 格式给出并纳入中国评价核数据库第二版 (CENDL-3)。

Evaluation of Complete Neutron Nuclear Data for Natural Nickel/MA Gonggui WANG Shiming (Institute of Nuclear Science and Technology, Sichuan University, Chengdu, 610064)

Some neutron nuclear data were evaluated for ^{nat}Ni in the energy range 10^{-5} eV to 20 MeV. The data included total, elastic, non elastic, total inelastic, inelastic cross sections to 33 discrete levels, inelastic continuum, (n, 2n), (n, 3n), (n, n'α)+(n, α n'), (n, n'p)+(n, pn'), (n, d), (n, t), (n, α), (n, γ), (n, 2p) and capture cross sections. The angular distributions of secondary neutron, the double differential cross sections (DDCS), the gamma ray production data and the resonance parameters are also included. The evaluation is based on both experimental data measured up to 1996 and calculated data with program UNF. The evaluated data will be adopted into CENDL-3 in ENDF/B-6 format.

Communication of Nuclear Data Progress/Liu Tingjin, et al (China Nuclear Data Center, China Institute of Atomic Energy, Beijing)

This is the 19th issue of *Communication of Nuclear Data Progress* (CNDP), in which the achievements in nuclear data field for the last year in China are carried. It includes the measurements of neutron activation cross sections on some nuclides, excitation functions of some reactions induced by charge particle and double differential cross section of ^{40}Ca(n, α) reaction; theoretical calculations of Zr(n, γ)

cross section, photonuclear reaction data, excitation function on some nuclides and direct inelastic scattering cross section and angular distribution of Pu isotopes; the evaluation of Ni isotope complete neutron nuclear data, some reference fission yield, activation cross sections and decay data; benchmark testing of CENDL-2.1 and its applications. Also the activities in nuclear data field are summarized.

CNIC-01300; CNDC-0023; INDC(CPR)-047/L 980015

Communication of Nuclear Data Progress/Liu Tingjin, et al (China Nuclear Data Center, China Institute of Atomic Energy, Beijing)

This is the 20th issue of *Communication of Nuclear Data Progress* (CNDP), in which the achievements in nuclear data field for the last year in China are carried. It includs the measurement of cross sections for ^{92}Mo(n, p) ^{92m}Nb reaction and deduction of low energy neutron; theoretical calculations of n+^{9}Be, ^{12}C, ^{85,87}Rb, ^{88,89,90}Sr, ^{89}Y, ^{113}Cd, ^{115}In, ^{121,123}Sb below 20 MeV and γ+^{51}V, ^{180,182,183,184,186}W below 30 MeV; evaluations of ^{63,65,Nat}Cu(n, α), (n, n'α) and γ+^{51}V reactions and ^{238}U fission product yields; a method and program CABEI for adjusting consistancy between the cross section data of natural element and its isotopes; testing of the tritium production for ^{6}Li and ^{7}Li; and fragment angular anisotropies and inertia parameters.

B00.00 化学、材料与地球科学 CHEMISTRY, MATERIALS AND EARTH SCIENCES

B10.00 化学 CHEMISTRY

B11.00 化学分析与同位素分析 Chemical and Isotopic Analysis

CNIC-01282; IAE-0188 980016

多γ窗符合测量方法的研究/刘云鹏 (中国原子能科学研究院，北京，102413)

在用 $4\pi\beta$-γ 符合法对具有复杂衰变纲图的放射性核素的活度进行测量时，通常采用效率外推法。实践证明，效率外推的结果通常与γ窗口的位置、曲线拟合的方幂、及最高β效率有关，因而其存在一定的系统不确定度。文中提出了多γ窗符合理论及其实现方法，该理论的给出，可以消除在对具有复杂衰变纲图的核素的活度进行外推测量时存在的系统不确定度，从而使符合测量建立在更完善的理论基础上。

Multi-gama Windows Coincidence Method/LIU Yunpeng (China Institute of Atomic Energy, Beijing, 102413) (*In Chinese*)

In $4\pi\beta$-γ coincidence measurement of radioactivity, efficiency extrapolation

method has been applied for a long time. Generally, the extrapolation curve is not linear so in practice an unspecified efficiency function which is usually defined simply as a polynomial in N_c/N_γ is introduced. Because of the unspecification of the efficiency function, systematic errors may arise theoretically from which the polynomial function is either inaccurate or unsuitable for extrapolation. To solve this problem, a new method is proposed, which is called multi-gama windows coincidence method, and a new linear extrapolation equation based on average β efficiency is strictly derived from the basic coincidence equations with the least approximation. Theoretically, this method is applicable to any simple or complex decay (except pure β decay and some decay with long life metastable energy level) with minimum systematic errors.

质子 X 荧光分析在大气气溶胶研究中的应用/朱光华 (北京师范大学低能核物理研究所, 北京, 100875)

为了确定 PIXE (质子 X 荧光分析) 的测量准确性, 进行了三个实验室的横向比对分析。比对中使用了 30 个单元素样品和一个多元素样品。结果显示, 对于绝大多数样品, 三家的一致性好于 10%, 三次测量的重复性相对于平均值好于 6%。用一个自动的时间顺序步进采样器在北京采集了大气气溶胶样品, 用 PIXE 对这些样品进行元素分析, 然后对元素浓度数据用绝对主因子分析 (APFA) 进行统计分析, 求出主成分以及它们解释的百分数。结果表明, PIXE 与统计方法相结合可以有效地分析出城市大气气溶胶的主成分, 并能将该地的和远地来的成分区别开来。用一个八级撞击式采样器在四个有代表性的地区进行了大气气溶胶采样, 从由 PIXE 分析得到的一些代表性元素浓度的粒径分布特征, 推断出大气气溶胶的来源。

PIXE Application to the Study of Atmospheric Aerosol/ZHU Guanghua (Institute of Low Energy Nuclear Physics, Beijing Normal University, Beijing, 100875)

In order to confirm the measurement accuracy of PIXE (Particle Induced X-ray Emission), crosscheck test were carried out between three laboratories. Thirty single element samples and one plural elements sample were used in the test. The agreements between three laboratories were evaluated to be better than 10% for the most of tested samples. The reproducibility test showed very good agreement and the dispersion in three times repeated PIXE measurements was within 6% on average. An automatic time sequence step sampler was used to collect atmospheric aerosol samples in Beijing. Element concentrations were analyzed by PIXE technique. Then the data were analyzed by the absolute principal factor analysis

(APFA) to evaluate the principal components and the percent variance explained by them. As a result, it shows that the PIXE analysis combined with statistical method can effectively resolve the aerosol components in urban area and distinguish between local and remote area aerosol components. The atmospheric aerosol samples were collected at four representative sites with an 8-stage cascade impactor sampler and analyzed for their elemental mass concentrations by PIXE analytic method. Based on some indicator elements, the characteristics of size distributions of particles from different sources were obtained.

B12.00 无机化学、有机化学与物理化学 Inorganic, Organic and Physical Chemistry

CNIC-01272; TSHUNE-0083 980018

微波脱硝用于高加浓铀转型的研究/鲍卫民，宋崇立 (清华大学核能技术设计研究院，北京，102201)

为了简化微波脱硝流程，硝酸铀酰在微波场中脱硝生成 UO_3 后进一步用微波加热，UO_3 即发生相变生成单一形态的氧化物 U_3O_8。相变时物料温升在 2 min 内达 200～300 ℃。通过输入功率可以控制相变温度。大约 500 ℃时可得到 U_3O_8，它不含残余的氮氧化物，其比表面积大于 3 m^2/g。用红外温度计及光纤温度计测量微波场中温度。针对设定的高加浓铀物料 (90 g(U)/L, 4 mol/L HNO_3 和每批操作 1.2 L)，研究了批式脱硝操作的工作曲线及工艺条件。

Research on the Conversion of Highly Enriched Uranium (HEU) Nitrate by Using the Microwave Denitration / BAO Weimin, SONG Chongli (Institute of Nuclear Energy Technology, Tsinghua University, Beijing, China, 102201)

In order to simplify the denitration process by microwave heating, the uranyl nitrate is firstly denitrated and converted into UO_3. The produced UO_3 was then further heated in the microwave field to transfer UO_3 to U_3O_8 and to form a single product of U_3O_8. When the phase transfer from UO_3 to U_3O_8 occurs, the temperature of the product increases 200～300 ℃ in two minutes. The phase-transfer temperature can be controlled by the input power of microwave. High quality U_3O_8 can be obtained at a denitration temperature about 500 ℃. It contains no residual NO_x and has a specific surface area great than 3 m^2/g. The denitration temperature is measured with an IR-thermometer and checked with an optic fiber thermometer. The working curve and process parameter were studied in a microwave denitration unit for high enriched uranyl nitrate solution (90 g (U)/L, 4 mol/L HNO_3 and 1.2 L per batch).

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