

# 天文专业英语文选

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南京大学外文系公共英语教研室编

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# 大学英语课文选

南京大学外文系公共英语教研室编

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## 1. THE CELESTIAL SPHERE

Although the stars are scattered through space at various distances from the earth, the difference in their distances is not perceptible to ordinary observation. All the stars seem equally remote. As we view the evening sky, we may imagine that the celestial bodies are set like jewels on the inner surface of a vast spherical shell. This *celestial sphere*, long regarded as a tangible surface, survives only as a convenient means of representing the heavens for many purposes. By this convention the stars can be shown on the surface of a globe or in projection on a plane map. Their positions are then denoted in the same ways that places are located on the globe of the earth.

The center of the celestial sphere may be the center of the earth, the observer's place on the earth's surface, the sun, or anywhere else we choose.① The size of the sphere is as great as we care to imagine it. Because the sphere is infinitely large, parallel lines, regardless of their actual distance apart when nearby, will appear to converge at some point a great distance away. This is a familiar axiom from our high school geometry studies. It is clearly demonstrated by the parallel railroad tracks, which seem to converge in the distance, or the parallel contrails of highflying aircraft. Similarly, parallel lines in space, regardless of their distance apart, are directed toward the same point on the remote celestial sphere.

The *apparent place* of a star is its position on the celestial sphere. It denotes the star's direction, and nothing else about its location in space. Where two stars have nearly the same direction, although one may be more remote than the other, they have nearly the same apparent place.<sup>②</sup> In addition, the apparent places of the sun, moon, and planets refer to their positions among the stars projected on the celestial sphere, as though all were at the same distance from us.<sup>③</sup> We say that the sun is entering the constellation Leo and remark on the nearness of the moon to a bright star.<sup>④</sup>

The *apparent distance* between two celestial bodies is accordingly their difference in direction; it is often called the *distance* (i.e. the angular distance) between them when there is no chance for ambiguity. Such distances are expressed in degrees. The distance between the pointers of the Big Dipper is somewhat more than  $5^\circ$ ; it is a convenient measuring stick for estimating other distances in the sky.

How may the place of a star be described so that other people will know where to look for it?<sup>⑤</sup> One way is to specify the constellation in which the star appears. If the star is in the constellation Perseus, anyone who can recognize the different constellations knows approximately where this star is situated.<sup>⑥</sup> A second way of denoting the apparent place of a star is with reference to circles of the celestial sphere, such as the horizon.

## 词 汇

perceptible [pə'septəbl] *a.* 看得出的

ordinary ['ɔ:dinəri] *a.* 平常的

set [set] (set [set]) *v.* 镶嵌  
 jewel ['dʒu:əl] *n.* 珠宝  
 shell [ʃel] *n.* 壳  
 regard [ri'gɑ:d] *v.* 当作  
 tangible ['tændzəbl] *a.* 有形的; 明确的  
 heaven ['hevən] *n.* 天空  
 projection [prə'dʒekʃən] *n.* 投影  
 map [mæp] *n.* 星图; 地图  
 anywhere ['eniweə] *ad.* 任何地方  
 choose [tʃu:z] (chose [tʃəuz], cho-  
 sen [tʃəuzn]) *v.* 选择  
 infinitely ['ɪnɪnɪtli] *ad.* 无限地  
 actual ['æktʃuəl] *a.* 实际的  
 apart [ə'pɑ:t] *ad.* 相距; 离开  
 converge [kən'veɜ:dʒ] *v.* 会聚  
 axiom ['æksiəm] *n.* 公理; 原则  
 geometry [dʒi'ɒmitri] *n.* 几何学

demonstrate ['dɒmənstreit] *v.* 证实;  
 表示  
 railroad ['reilrəʊd] *n.* 铁道  
 contrail ['kɒntrɪl] *n.* 凝结尾流  
 highflying [haɪ'flaɪɪŋ] *a.* 高飞的  
 aircraft ['ækra:ft] *n.* 飞机  
 similarly ['simɪləli] *ad.* 同样地  
 Leo ['li:əu] *n.* 狮子座  
 remark [ri'mɑ:k] *n., v.* 评论; 议论  
 ambiguity [æmbɪ'gju:iti] *n.* 混淆,  
 两可  
 pointer ['pɔɪntə] *n.* 指极星  
 dipper ['dɪpə] *n.* 杓  
 Big Dipper 北斗七星  
 stick [stɪk] *n.* 枝; 枝  
 specify ['spesɪfaɪ] *v.* 指定; 详细说明  
 Perseus ['pɜ:siəs] *n.* 英仙座  
 situate ['sɪtʃueɪt] *v.* 使位于

## 词 组

(to) regard ... as 把...当作  
 (to) care to 愿意  
 regardless of 不管

in addition 此外  
 as though 虽然  
 (to) look for 寻找

## 注 释

- ① ... may be the center of the earth, the observer's place on the earth's surface, the sun, or anywhere else we choose.

the center of the earth, the observer's place ..., the sun, or anywhere ... 是并列的表语, we choose 是省略掉关系代词的定语从句, 修饰 anywhere.

- ② Where two stars have nearly the same direction, although one may be more remote than the other, they have nearly the same apparent place.

这是个主从复合句。在 where 引导的状语从句中, 又有一个由 although 引导的让步状语从句, 修饰 have nearly the same direction.

- ③ ... as though all were at the same distance from us.

as though = as if, 引导方式状语从句, 它的谓语动词要用虚拟语气,

动词 be 要用 were.

- ④ We say that the sun is entering the constellation Leo and remark on the nearness of the moon to a bright star.

that 引导名词从句,作 say 的宾语;动词 remark (谈论) 与 say 为并列谓语。

- ⑤ How may the place of a star be described so that other people will know where to look for it?

这是个特殊疑问句,其中包含一个由 so that 引导的目的状语从句,在该从句中,主语为 other people, 连接副词 where + 不定式短语(to look for it) 作 know 的宾语。

- ⑥ ... anyone who can recognize the different constellations knows approximately where this star is situated.

这是个主从复合句。who 引导的是个定语从句,修饰 anyone; where 引导的是个名词从句,作主句中谓语动词 knows 的宾语。



## 2. THE CELESTIAL COORDINATES

The stars rise and set, daily circling westward and keeping precisely in step as they go around. The patterns of stars, such as the Big Dipper, look the same night after night and year after year. It is as though the stars were set on the inner surface of a rotating hollow globe. This celestial sphere seems to turn daily from east to west around an axis which is the axis of the earth's rotation projected to the sky.

The *celestial poles* are the two opposite points on the celestial sphere toward which the earth's axis is directed, and around which the stars circle.<sup>①</sup> The north celestial pole is directly in the north, from a third to halfway up in the sky for observers in different parts of the United States. The south celestial pole is similarly depressed below the south horizons of these places.

The pointers of the Big Dipper direct the eye to Polaris, the *pole star*, at the end of the Little Dipper's handle. This moderately bright star is within  $1^\circ$ , or about two moon-breadths, of the pole itself. It is also the *north star* showing the approximate direction of north. The south celestial pole is not similarly marked by any bright star in its vicinity.

Just as the earth's equator is halfway between the terrestrial poles, so the *celestial equator* is halfway between the north and south celestial poles.<sup>②</sup> This circle crosses

the horizon at its east and west points at an angle that is the complement of the latitude. Thus in latitude  $40^{\circ}\text{N}$ , the celestial equator is inclined  $50^{\circ}$  to the horizon and has an altitude of  $50^{\circ}$  at its highest point in the south, the complement of  $40^{\circ}$  being  $90^{\circ} - 40^{\circ}$  or  $50^{\circ}$ .<sup>③</sup>

*Hour circles* in the sky are like longitudes on the earth. They are half circles that connect the celestial poles and are therefore perpendicular to the equator. Unlike the circles of the horizon system, which are stationary relative to the observer, these circles are to be considered as sharing in the rotation of the celestial sphere.<sup>④</sup> If 24 hour circles are imagined equally spaced, they will coincide successively with the observer's celestial meridian at intervals of an hour. With reference to the celestial equator and its associated circles, the position of a celestial body is given by its right ascension and declination, which resemble terrestrial longitude and latitude.

The *right ascension* of a star is its angular distance measured eastward along the celestial equator from the *vernal equinox* to the hour circle through the star.<sup>⑤</sup> (The *vernal equinox* is the point where the sun's center crosses the celestial equator at the beginning of spring.) Right ascension is expressed in time more often than in angular units. Because a complete rotation of the heavens, through  $360^{\circ}$ , is made in 24 hours,  $15^{\circ}$  is equivalent to 1 hour, and  $1^{\circ}$  to 4 minutes of time. Thus a star's right ascension may be given as  $60^{\circ}$  or 4 hours.

The *declination* of a star is the star's distance in degrees north or south from the celestial equator, measured along an hour circle through the star. The declination is

marked either N or with a plus sign if the star is north of the equator, and S or with a minus sign if it is south.

The hour angles are often employed in the equator system instead of right ascension. The local *hour angle* of a star is reckoned westward along the equator from the observer's celestial meridian through  $360^\circ$  or 24 hours. Unlike right ascension, which remains nearly unchanged during the day, the hour angle of a star increases at the rate of  $15^\circ$  per hour and, at the same instant, has different values for observers in different longitudes.

## 词 汇

**coordinate** [kəu'ɔ:dɪnɪt] *n.* 座标  
**precisely** [pri'saɪsli] *ad.* 精确地  
**hollow** ['hɒləʊ] *n.* 空的  
**Polaris** [pəu'læris] *n.* 北极星  
**handle** ['hændl] *n.* 柄  
**moon-breadth** ['mu:nbredθ] *n.* 月宽  
**approximate** [ə'prɒksɪmɪt] *a.* 大致的  
**complement** ['kɒmplɪmənt] *n.* 余角  
**connect** [kə'nekt] *v.* 联结  
**perpendicular** [ˌpɜ:pən'dɪkjələ] *a.* 垂直的  
**space** [speɪs] *v.* 间隔, 隔开

**coincide** [ˌkəuɪn'saɪd] *v.* 相合, 一致  
**vernal** ['vɜ:nəl] *a.* 春的  
**equinox** ['i:kwɪnɒks] *n.* 分点  
**vernal equinox** 春分点  
**express** [ɪks'pres] *v.* 表示  
**equivalent** [i'kwɪvələnt] *a.* 等值的  
**plus** [plʌs] *n., a.* 加; 正的  
**minus** ['maɪnəs] *n., a.* 减; 负的  
**reckon** ['rekən] *v.* 计算  
**unlike** ['ʌnlaɪk] *a., prep.* 不象, 不相同  
**unchanged** [ˌʌn'tʃeɪndʒd] *a.* 不变的  
**per** [pɜ:] *prep.* 每  
**instant** ['ɪnstənt] *n.* 时刻

## 词 组

(to) **keep in step** 步调一致  
 (to) **direct to** 指向  
 at the end of 在末端  
 (to) **be perpendicular to** 与...垂直  
 (to) **coincide with** 和...一致  
 at the beginning of 在...开始时

**in time** 用时间  
**in angular unit** 用角单位  
 (to) **be equivalent to** 和...相等, 等于  
**hour angle** 时角  
 at the same instant 同一时刻, 同时

## 注 释

- ① The celestial poles are the two opposite points on the celestial sphere toward which the earth's axis is directed, and around which the stars circle.

toward which ... directed 和 around which ... circle 是并列的限制性定语从句, 修饰 points; 关系代词 which 作介词 toward 和 around 的宾语。

- ② Just as the earth's equator is halfway between the terrestrial poles, so the celestial equator is halfway between the north and south celestial poles.

连接词 just as (就象...一样) 引导方式状语从句, 主句中常用 so 与之呼应。

- ③ ... the complement of  $40^\circ$  being  $90^\circ - 40^\circ$  or  $50^\circ$ .

这是独立分词结构作状语, 表示原因; the complement of  $40^\circ$  是现在分词 being 的逻辑主语。

- ④ Unlike the circles of the horizon system, which are stationary relative to the observer, these circles are to be considered as sharing in the rotation of the celestial sphere.

这是个主从复合句。主句中介词短语 as ... sphere 作主语补足语; 介词短语 unlike ... observer 作状语, 在这个短语中又包含了一个非限制性定语从句 which ... observer.

- ⑤ ... measured eastward along the celestial equator from the vernal equinox to the hour circle through the star.

这是个过去分词短语, 用作 distance 的定语; 其中副词 eastward 和介词短语 along ... equator, from...equinox to ... circle 都作状语, 修饰 measured; 介词短语 through the star 作定语, 修饰 hour circle.

### 3. THE ECLIPTIC

The earth revolves eastward around the sun once in a year and at the same time rotates on its axis in the same direction once in a day. The earth's axis is inclined  $23.5^\circ$  from the perpendicular to the plane of its orbit, or we may say that the earth's equator is inclined  $23.5^\circ$  to the plane of the orbit. This determines the relation between the celestial equator and the eastward path the sun seems to describe around the heavens as we revolve around the sun.①

The *ecliptic* is the sun's apparent annual path around the celestial sphere; it is a great circle inclined  $23.5^\circ$  to the celestial equator. The ecliptic is in the plane of the earth's orbit, and the celestial equator is in the plane of the earth's equator. The *north* and *south ecliptic poles* are  $90^\circ$  from the ecliptic, and are, respectively,  $23.5^\circ$  from the north and south celestial poles. The north ecliptic pole (R.A.  $18^h$ , Decl.  $66.5^\circ$  N) is in the constellation Draco.

The *equinoxes* are two opposite points on the celestial sphere where the ecliptic crosses the celestial equator. They are so named because days and nights are said to be equal in length when the sun arrives at an equinox, although atmospheric refraction makes the duration of sunlight slightly the longer on such occasions.② The *solstices* are two opposite points midway between the equinoxes, where the ecliptic is farthest north or south from the celestial

equator. Here the "sun stands", so far as its north and south motion is concerned, as it turns back toward the equator.③

The equinoxes and solstices are points on the celestial sphere; their positions in the constellations are shown in the star maps. The *vernal equinox* (R.A.  $0^h$ , Decl.  $0^\circ$ ) is the point where the sun crosses the celestial equator on its way north, about 31 March. The *summer solstice* (R.A.  $6^h$ , Decl.  $23.5^\circ N$ ) is the northermost point of the ecliptic; the sun arrives here about 22 June. The *autumnal equinox* (R.A.  $12^h$ , Decl.  $0^\circ$ ) is the point where the sun crosses the celestial equator on its way south, about 23 September. The *winter solstice* (R.A.  $18^h$ , Decl.  $23.5^\circ S$ ) is the southermost point of the ecliptic; the sun arrives here about 22 December. These dates vary a little from year to year owing to the plan of leap years. In each case the positions of the sun refer to the sun's center.

The celestial equator keeps the same position in the sky throughout the year. It is inclined to the horizon at an angle that is the complement of the latitude. Thus in latitude  $40^\circ N$  the equator crosses the horizon at the east and west points at an angle of  $50^\circ$ , and is  $50^\circ$  above the horizon in the south. The ecliptic, however, takes different positions in the evening sky during the year.

Because the ecliptic is inclined  $23.5^\circ$  to the celestial equator, its inclination to the horizon can differ as much as  $23.5^\circ$  either way from that of the equator. At sunset at the beginning of autumn in middle northern latitudes the ecliptic is least inclined to the horizon; the moon and bright planets that may be visible at the time are seen

rather low in the south. At sunset at the beginning of spring the ecliptic is most inclined to the horizon; the moon and planets are then crossing more nearly overhead.

A number of features familiar to watchers of the skies are affected by the varying angle between the ecliptic and horizon. Among these are the harvest moon, the direction of the horns of the crescent moon, the favorable times for seeing the planet Mercury as evening or morning star, and the favorable seasons for viewing the zodiacal light.<sup>④</sup>

## 词 汇

**annual** ['ænjuəl] *a.* 每年的  
**R.A. = right ascension** [rait ə'sen-  
 fən] *n.* 赤经  
**Decl. = declination** [ˌdekli'neiʃən]  
*n.* 赤纬  
**Draco** ['dreikəʊ] *n.* 天龙座  
**refraction** [ri'frækʃən] *n.* 折射  
**occasion** [ə'keɪʒən] *n.* 时机  
**solstice** ['sɒlstɪs] *n.* 至点  
     **summer solstice** 夏至点  
**northernmost** ['nɔ:θəməʊst] *a.* 最北

的  
**southernmost** ['sʌθəməʊst] *a.* 最南的  
**date** [deɪt] *n.* 日期  
**leap** [li:p] (leapt [lept]) *v.* 跳跃  
     **leap year** 闰年  
**watcher** ['wɒtʃə] *n.* 观察者  
**harvest** ['hɑ:vəst] *n., v.* 收获  
     **harvest moon** 获月  
**favorable** ['feɪvərəbl] *a.* 有利的  
**zodiacal** ['zəʊdiækəl] *a.* 黄道的

## 词 组

**in length** 就长度而言  
**on an ... occasion** 在某一时机  
**so far as ... is concerned** 就...而言  
**on its way north** 北行时

**on its way south** 南行时  
**owing to** 由于  
**in each case** 在每一情况下

## 注 释

- ④ This determines the relation between the celestial equator and the eastward path the sun seems to describe around the heavens as we revolve around the sun.

这是个主从复合句。the sun seems to describe around the heavens

是省略了关系代词的限制性定语从句,修饰 path; 这个从句中又带了一个由 as 引导的时间状语从句,修饰 seems to describe.

- ② They are so named because days and nights are said to be equal in length when the sun arrives at an equinox, although atmospheric refraction makes the duration of sunlight slightly the longer on such occasions.

这是个主从复合句。because 引导的是原因状语从句,修饰主句中的谓语动词 are so named; 该从句又被 when 引导的时间状语从句和 although 引导的让步状语从句所修饰。

- ③ Here "the sun stands", so far as its north and south motion is concerned, as it turns back toward the equator.

so far as ... is concerned 意思是“就...而言”,作为插入语,插在主句和 as 引导的状语从句之间。

- ④ Among these are the harvest moon, the direction of the horns of the crescent moon, the favorable times for seeing the planet Mercury as evening or morning star, and the favorable seasons for viewing the zodiacal light.

这是个倒装句。介词短语 among these 作表语, these 指上句中的 features, 谓语动词 are 位于主语 the harvest moon, the direction of the horns of the crescent moon, the favorable times 和 the favorable seasons 之前; 介词短语 for seeing the planet 和 for viewing the zodiacal light 都作定语,分别修饰它们前面的 times 和 seasons; 介词短语 as evening or morning star 作 seeing 的宾语补足语。



#### 4. THE EARTH'S PRECESSION

If a top is spinning with its axis inclined to the vertical, the axis moves around the vertical line in the direction of the spin. The rotation of the top resists the effort of gravity to tip it over, and the conical motion of the axis results, until the spin is so reduced by friction that the top falls over.<sup>①</sup>

The earth is rotating similarly on an axis that is inclined to the ecliptic plane, which is nearly the plane of the moon's motion around us. The attractions of the moon and sun on the earth's bulging equator tend to bring the earth into the plane with themselves, and thus to straighten up the earth's axis relative to its orbit.<sup>②</sup> Their efforts are resisted by the rotation, so that the earth's axis moves slowly around the line joining the ecliptic poles in the direction opposite to that of the rotation,<sup>③</sup> once around in approximately 26,000 years at the present rate. This is the *earth's precession*.

As the earth's axis goes around in the precessional motion, the celestial poles, toward which the axis is directed, move among the constellations. The poles describe circles  $23.5^\circ$  in radius around the ecliptic poles, bringing successively to bright stars along their paths the distinction of being the pole star for a time.<sup>④</sup> Thus alpha Draconis was the pole star in the north 5000 years ago, the predecessor of our present pole star.