telescope. The prisms are necessarily compound, and usually consist of flint glass with compensating prisms of crown. In all eases where compound prisms are used, the angles must be accurately calculated. Amici in 1860 devised such an instrument; an improved form by Jannsen was made up of two flint and three crown prisms, and in Browning’s form there are three flint and four crown. Sorby and, later, Abbe, designed instruments on the same principle to be used in connexion with the microscope. By suitably replacing the ocular of the observing telescope in an angular vision spectroscope by a photographic camera, it is possible to photograph spectra; such instruments are termed spectrographs. In grating spectroscopes both plane and concave gratings are employed in connexion with a collimator and observing telescope.

Authorities.—The standard work is H. Kayser, *Handbuch der Spectroscopie* (1900-1910, vol. v.). See also J. Landauer, *Spectrum Analysis* (Eng. trans. by J. B. Tingle, 1898); E. C. C. Baly, *Spectroscopy* (1905). For spectra see A. Hagerbach and H. Konin, *Atlas of Emission Spectra* (Eng. trans. by A. S. King, 1905); F. Exner and E. Haschek, *Wellenlängen-Tabellen* (1902-1904); W. Μ. Watts, *Index of Spectra* ; also reports of B.A. Special Committee.

**SPECULATION,** a round game of cards at which any reasonable number can play. Each player contributes a stake to the pool, the dealer staking double. Three cards are dealt face downwards to each player; the top card of those left is turned up for trumps. Each player, beginning with the player on the dealer’s left, turns up a card; if it is not a trump, or is a lower trump than the trump-card, the next player turns up one of his cards, and so on till a higher trump than the trump-card appears, the values being reckoned as at whist. The holder may sell this card to the highest bidder, or retain it. The turning-up proceeds till a still higher trump is found, but the holder of the original highest does not turn up till his card is beaten. The new card may then be sold. The dealer may not turn up till the trump-card has been beaten. The holder of the highest trump when all the hands have been exposed takes the pool. If the ace of trumps is the trump-card, the dealer takes the pool; if it is turned up during play, the hand is, of course, at an end. Variations of the game allow the purchase of unseen cards or hands, or of the trump-card, even before it is turned up. The cards used in one deal are not dealt again till the whole pack has been gradually dealt out; they are collected and shuffled by the “ pone ”—the player on the dealer’s right—to be used when the pack is exhausted.

**SPECULUM,** the Latin word for a mirror, employed more particularly for a metallic mirror used in a reflecting telescope. In early instruments metallic mirrors, made from an alloy of copper and tin, with the addition of a little arsenic or other metals to increase the whiteness, were customarily employed, but they have now been displaced by the more convenient silver- on-glass mirror (see Telescope). Various forms of specula are used in surgery for examining internal organs.

**SPEDDING, JAMES** (1808-1881), English author, editor of the works of Bacon, was born on the 26th of June 1808, in Cumberland, the younger son of a country squire. He was educated at Bury St Edmunds and Trinity College, Cambridge, where he took a second class in the classical tripos, and was junior optime in mathematics in 1831. In 1835 he entered the colonial office, but he resigned this post in 1841. In 1842 he was secretary to Lord Ashburton on his American mission, and in 1855 he became secretary to the Civil Service Commission; but from 1841 onwards he was constantly occupied in his researches into Bacon’s life and philosophy. On the 1st of March 1881 he was knocked down by a cab in London, and on the 9th he died of erysipelas. His great edition of Bacon was begun in 1847 in collaboration with R. E. Ellis and D. D. Heath. In 1853 Ellis had to leave the work to Spedding, with the occasional assistance of Heath, who edited most of the legal writings. The *Works* were pub- lished in 1857-1859 in seven volumes, followed by the *Life and Letters* (1861-1874). Taken together these works contain practically all the material which exists in connexion with the subject, collected and weighed with the utmost care and im­partiality. Spedding humorously emphasized his devotion to Bacon in the title of one of his non-Baeonian works, *Reviews and Discussions, Literary, Political and Historical, not relating to Bacon* (1879); and his literary remains outside that one field are no longer of interest. But as a' Baconian scholar he is not likely soon to be superseded.

**SPEED, JOHN** (1552-1629), English historian and carto­grapher, was born, according to Fuller, at Farringdon, Cheshire, He was the son of a London tailor, and followed his father’s trade, being admitted member of the Merchant Taylors Company in 1580. He settled in Moorfields, where he built himself a house. He was enabled to give up bis trade and to devote himself to antiquarian pursuits through the kindness of Sir Fulke Greville, whom Speed calls the “ procurer of my present estate,” and through his patron’s interest he also received a “ waiter’s room in the custom-house.” The results of the leisure thus secured to him appeared in 1611 in his *Theatre of the Empire of Great Britaine,* a series of fifty-four maps of different parts of England, which had already appeared separately, and in which he was helped by Christopher Saxton, John Norden and William White. To each map descriptive matter was attached. In 1611 also he published his *History of Great Britaine under the Conquests of the Romans . . . to . . . King James.* Speed acknowledges his obligations to the chief antiquaries and historians of his day. Sir Robert Cotton lent him manuscripts and coins, and is said to have revised the proofs for him; in heraldry he acknowledges the help of William Smith (1550?- 1618); and he had valuable help from John Barkham (1572?- 1642) and Sir Henry Spelman. Speed brought some historical skill to bear on the arrangement of his work, and although he repeated many of the errors of older chroniclers he added valuable material for the history of his country. He died in London on the 28th of July 1629.

Other maps of his, beside those in the *Theatre,* are in the British Museum. Another edition of the *Theatre* is *Theatrum Magnae Βritanniae latine,* redditum a P. Holland (London, folio, 1616). He wrote *Genealogies Recorded in Sacred Scriptures* (1611), and a similar work, *A* *Cloud of Witnesses* (1616). These passed through numerous editions, and were frequently prefixed to copies of the Bible. An account of Speed’s descendants is to be found in Rev. J. S. Davies’s *History of Southampton* (1883), which was founded on MS. material left by John Speed (1703-1781).

**SPEETON BEDS,** in English geology, a series of clays well exposed at Speeton, near Filey on the Yorkshire coast. Peculiar interest attaches to these beds for they are the principal repre- sentatives in Britain of the marine phase of the Lower Creta- ceous system. The Speeton Clays pass downwards without break into the underlying Kimeridgian; they are capped by the Red Chalk, which may be regarded as the equivalent of the Upper Gault of southern England. These beds thus form a passage series between *marine* Jurassic strata and those belong- ing undoubtedly to the Cretaceous system; in this way they correspond with the Purbeek-Wealden rocks, which form a connecting link between *estuarine* Jurassic and Cretaceous strata.

Above the dark, bituminous, nodular shales with Kimeridge fossils at the base of the Speeton Clay comes the zone of *Belem­nites lateralis* (34 ft.), with *Olcostephanus graυesiformis, O. rotula,* and species of *Hoplites* and *Oxynoticeras;* this is followed by the zone of *Belemnites jaculurn,* with *B. cristatus, Olcostephanus (Astieria) astieri, O. (Simbirskites) inυersus* and *O.* (5.) *Speetonensis* in ascending order; *Echinospatagus cordiformis,* a species found in the typical Neocomian area, also occurs in this zone. The next higher zone is that of *Belemnites brunsvicensis ( = (semi- canaliculatus)* (100 ft.), with *B. Speetonensis, Hoplites des- hayesii,* and *Amaltheus bicurνatus.* The topmost zone is charac­terized by *Belemnites minimus* with *Inoceramus concentrions* and *I. sulcatus;* it consists of a few feet of mottled clays. It appears, therefore, that while the lower portions of the Speeton Clay are the equivalents of the Wealden and perhaps of the Pur­beck beds, the higher portions are the equivalents of the Lower Greensand and part of the Gault. In Lincolnshire the upper Speeton beds are represented by the Carstone and Tealby Lime- stone and Clay, and the lower Speeton by the Claxby Ironstone, Spilsby Sandstone and lower part of the Tealby clay. A similar faunal horizon is recognized in Heligoland and Russia.

See Cretaceous; Neocomian; Kimeridgian; also G. W. Lamρ- lugh, *Q.J.G.S.* (1889), xlv. (1896), lii. ; *Rep. Brit. Assoc.* (1890); A. Pavlow and G. W. Lamplugh, *Bull. soc. imp. nat. Moscow* (1891), and *Q.J.G.S.* (1897), liii.