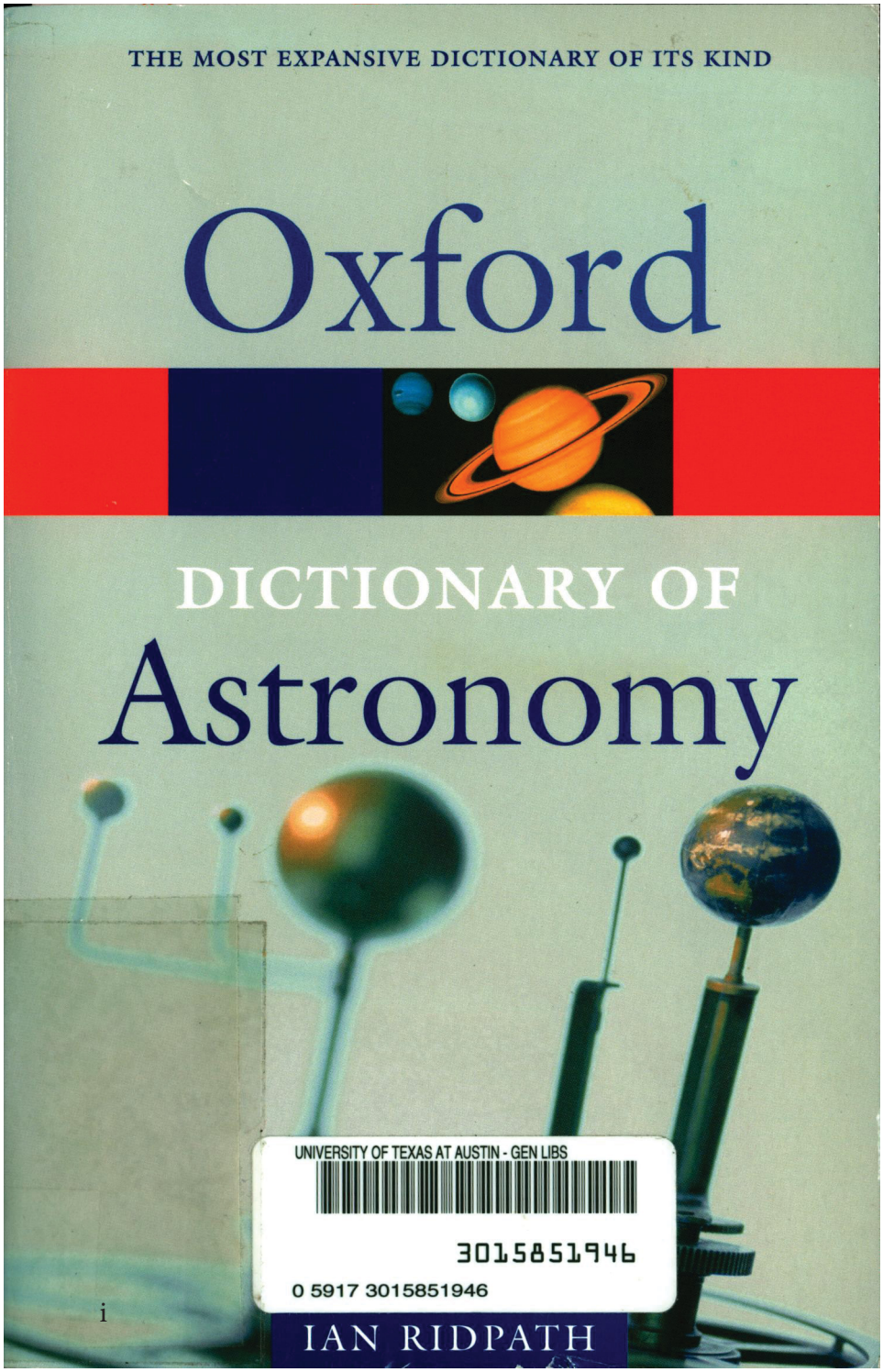

A Dictionary of

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components. The *Quadrantid meteor shower radiates every January from northern Boötes.

boson A particle such as a *photon, a *meson, an atomic nucleus of even mass number (e.g. the commonest type of helium nucleus), or the hypothetical *graviton which has a zero or integer value of *spin. They do not obey the Pauli exclusion principle. Bosons are named after the Indian physicist Satyendra Nath Bose (1894–1974). *See also* FERMION.

Boss General Catalogue (GC) Popular name for the five-volume *General Catalogue of 33,342 Stars* compiled in 1936–7 by the American astronomer Benjamin Boss (1880–1970). This catalogue contains positions and proper motions of all stars brighter than 7th magnitude over the whole sky, plus thousands of fainter stars for which accurate proper motions could be determined. It was a successor to the *Preliminary General Catalogue* of 6188 stars published in 1910 by his father, Lewis Boss (1846–1912), who also initiated the larger catalogue.

boundary layer In a planetary atmosphere, the level of the atmosphere in direct contact with the planet's surface, in which friction between the surface and the air plays a significant role in determining atmospheric movements. On Earth, the boundary layer lies at the base of the *troposphere and varies in depth from a few hundred metres under stable conditions to 1–2 km when convection is strong.

bound–bound transition A change to the energy of an electron within an atom, or more rarely within a molecule, in which the electron remains attached (bound) to the atom or molecule both before and after the change. When the energy is increased, a photon is absorbed; when the energy is reduced, a photon is emitted. Bound–bound transitions produce the emission and absorption lines found in stellar spectra.

bound–free transition A change to the energy of an electron within an atom or a molecule in which the electron gains sufficient energy to escape. The electron goes from being bound to being free, and leaves behind an ion; hence this is another name for *ionization. The energy for the change may come from a photon, resulting in the absorption bands known as *ionization edges* in stellar spectra, or from collisions with other atoms or particles (*collisional ionization*). If the energy comes from another excited electron within the atom, the process is known as *auto-ionization*.

Bouwers telescope A design of telescope identical to the *Maksutov telescope, developed by the Dutch optician Albert A. Bouwers (1893–1972). His publication of the design in 1940, during World War II, predated that of the *Maksutov telescope, but gained little publicity because of the German occupation of Holland.

Bowen, Ira Sprague (1898–1973) American astrophysicist. In 1927 he explained the origin of strong green lines in the spectra of planetary nebulae. They are *forbidden lines produced by transitions between atomic states in doubly ionized oxygen (O III) and not, as W. *Huggins had earlier speculated, by an unknown element termed 'nebulium'. This led to the correct identification of lines in the solar spectrum that had been similarly attributed to a hypothetical 'coronium', and thence to advances in the spectroscopic study of the compositions, temperatures, and densities of the Sun, stars, and nebulae.

Bowen fluorescence A mechanism that gives rise to certain strong emission lines from ionized atoms of oxygen, carbon, and nitrogen in diffuse nebulae. Extremely hot stars and accretion disks (at temperatures of 30 000 K or more) produce copious amounts of extreme ultraviolet radiation at 30.4 nm from singly ionized helium atoms. These photons excite the ions of C III and N III in surrounding gas because the ions have a transition very close to this wavelength. These excited ions then return to the