Far-Ultraviolet Detection of the Suspected Subdwarf Companion to the Be Star 59 Cygni

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We report on the detection of a hot subdwarf component in the Be binary system, 59 Cygni. The spectral signature is found in cross-correlation functions of photospheric model spectra with far-ultraviolet spectra obtained by the International Ultraviolet Explorer Satellite, and we used radial velocities from the cross-correlation functions to determine a double-lined spectroscopic orbit. The individual spectra of the binary components were extracted using a Doppler tomography algorithm. The flux of the system is dominated by the rapidly rotating Be star. However, the subdwarf contributes approximately 4% of the UV flux, and its spectrum bears a strong resemblance to that of the hot sdO star BD +75Â°325. Based on the appearance of the UV spectrum and the orbital elements, we present estimates for the stellar masses, radii, and temperatures. The presence of the hot companion causes excess emission from the outer part of the Be disk facing the companion. We present a set of red spectra that show the orbital phase variations of the He I Î»6678 emission formed in the heated region of the disk, which probably occurs near the disk outer boundary. 59 Cygni, FY Canis Majoris, and phi Persei comprise the known set of Be binaries with detected hot evolved companions, which are the stripped down remains of mass transfer. Their properties demonstrate that some fraction of Be stars were spun up through angular momentum transfer by Roche lobe overflow.

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