

Searching for Planets around “Adolescent” Stars

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Stellar activity, and the strength of stellar winds, decreases with stellar age. While this decrease makes radial velocity searches more productive, planetary magnetospheric emissions are powered by stellar winds, so they will be *less* productive. We are engaged in a two-part search for planets around young, main-sequence stars.

(1) We have conducted a multi-epoch search for the magnetospheric emission from the planet orbiting τ Boo. Empirical relations developed for solar system planets suggest that this planet may be detectable at 4-meter wavelength (74 MHz) with the Very Large Array. Our single-epoch limits are approximately 200 mJy, implying a luminosity less than about 10^{19} ergs/s unless its radiation is highly beamed into a solid angle $\Omega \ll 1$. While within the range of predicted luminosities, this value is lower than estimates that take into account the known stellar wind properties of τ Boo. Solar system planetary emission is beamed, but with characteristic solid angles of approximately 1 sr.

(2) We are assembling a census of nearby young stars of spectral class F, G, and K, as their stellar winds are potentially orders of magnitude more powerful than that of the Sun. Accordingly, planets in orbit about them are likely to have much stronger magnetospheric emissions than the solar system planets. This search is designed, in part, to mitigate a selection bias in current radial velocity searches in which young stars are not observed because their high activities make it problematic to isolate a planetary signal. If iron-rich “super-Earths” exist, with strong magnetic fields, they may also power radio emissions that this search might detect.

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