Rotation and Spitzer/IRAC fluxes in Orion

L.M. Rebull (SSC/JPL; rebull@ipac.caltech.edu), J.R. Stauffer (SSC/JPL), T. Megeath (CfA), J. Hora (CfA), L. Hartmann (CfA/U. Mich.)

Much effort has been expended in recent years on deciphering the influence of circumstellar disks on rotation in pre-main-sequence stars. Early observations of T Tauri stars suggested that stars with evidence of circumstellar accretion disks rotated more slowly than stars without such evidence (e.g., Edwards et al. 1993, AJ, 106, 372). More recent observations have muddied the waters; for example, Rebull et al. (2001, AJ, 121, 1676) finds no clear correlation between disk excess and rotation rate. Complicating this discussion, near-IR circumstellar disk indicators, though the most widely available, are subject to uncertainties that can result from inner disk holes and/or the system inclination (see, e.g., Hillenbrand et al. 1998, AJ, 116, 1816) and/or contrast between the disk and the photosphere and/or disk geometry (e.g., the size of the inner disk wall). Mid-infrared observations are less sensitive to such effects, but until now, these observations have been difficult to obtain. The Spitzer Space Telescope (Werner et al. 2004, ApJS, 154, 1) now easily enables mid-infrared measurements of many stars at once down to substellar masses. Megeath et al. (2005, in prep) surveyed the Orion Molecular Clouds ($\sim$3 Myr) with the IRAC instrument (3.6, 4.5, 5.8, 8 microns) as part of a joint IRAC and MIPS GTO program. In this contribution, we examine the relationship between rotation and Spitzer mid-IR fluxes for $\sim$900 stars in Orion for stars between 3 and 0.1 Msun. **We find for the first time a clear indication that stars with longer periods are more likely than those with short periods to have IR excesses suggestive of disks**; see Figure. The three panels of the Figure portray separately all of the stars available in Orion, those just in the Orion Nebula Cluster (ONC), and those in the Orion Flanking Fields (FF), which are four fields to the N, S, E, and W of the ONC region (see Rebull et al. 2000, 119, 3026); stars in the FF are slightly older than those in the ONC. Clearly, a long-period star is more likely to have a disk than a short-period star, but there are also substantial numbers of long-period stars with little or no excess. These latter stars may have just recently cleared their disks and have not yet spun up in response to contraction on their way to the ZAMS.

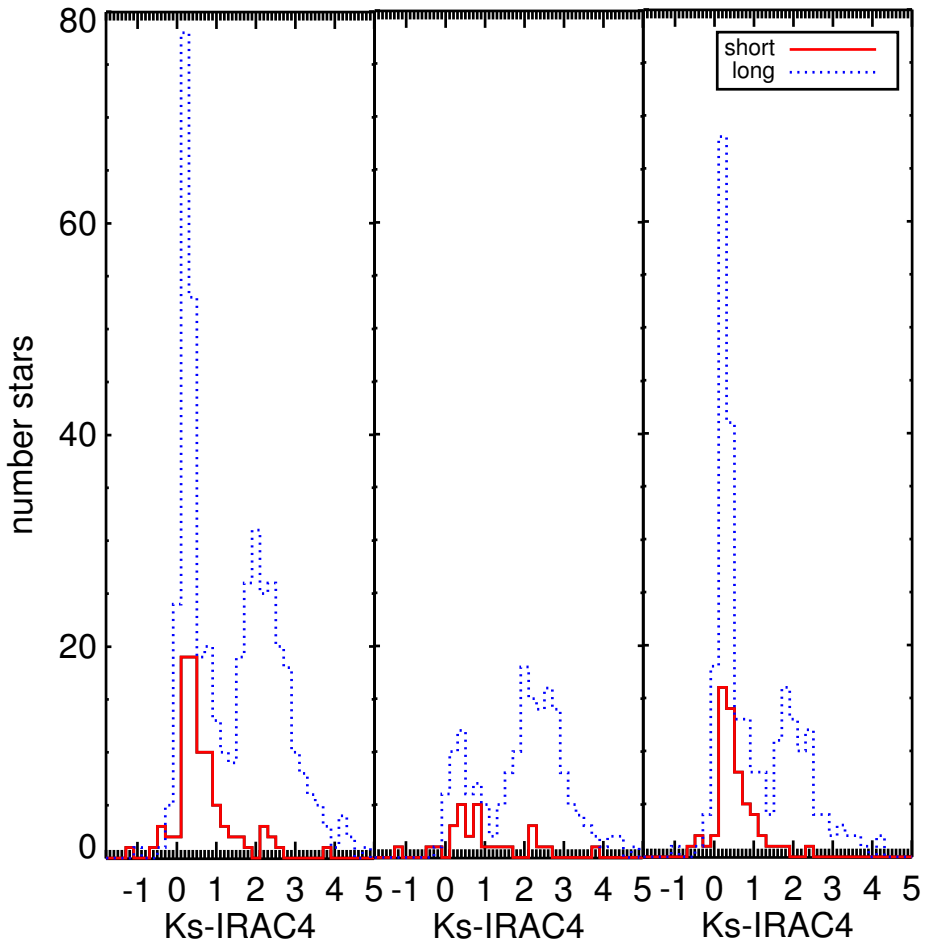

Figure 1: Histograms of infrared excess 2MASS K band - IRAC band 4 (8 microns) for stars with rotation periods shorter than (red solid line) and longer than (blue dotted line) 1.8 days. The three panels of the Figure are, from left to right, all of the stars available in Orion, those just in the Orion Nebula Cluster (ONC), and those in the Orion Flanking Fields (FF). Stars with longer periods are more likely than those with short periods to have IR excesses suggestive of disks.