PROTOPланETARY DISKS AROUND COOL STARS: DIFFERENCES IN THE DISK STRUCTURE, DUST PROCESSING AND ORGANIC CHEMISTRY. D. Apai1, I. Pascucci2 1Space Telescope Science Institute, Baltimore. E-mail: apai@stsci.edu 2Department of Physics and Astronomy, Johns Hopkins University, Baltimore.

Introduction: The Sun is neither an average or a typical star: the galactic stellar population is dominated by cool red dwarf stars and brown dwarfs. We now know that also these cool objects form via disk accretion and at an age of a few million years are often surrounded by the remnants of their accretion disks, possible sites for planet formation [e.g. 1, 2]. Given their low masses and temperatures, and tiny luminosity the question naturally arises: How will the conditions for planet formation differ around these stars from those around sun-like stars?

Here, we review results from our comprehensive, comparative mid-infrared Spitzer spectroscopic study of the dust and gas properties of disks around young Sun-like stars and cool stars/brown dwarfs [3].

Results: The comparison of these two large samples of over 60 sources reveal major differences in the evolution of both the dust and gas components [3]. We report the first detection of organic molecules in disks around brown dwarfs. The detection rate statistics and the line flux ratios of HCN and C2H2 show a striking difference between the two samples, demonstrating a significant under-abundance of HCN relative to C2H2 in the disk surface of cool stars. We propose this to originate from the large difference in the UV irradiation around the two types of sources. The statistical comparison of the 10 μm silicate emission features also reveals a difference between the two samples. Cool stars and brown dwarfs show weaker features arising from more processed silicate grains in the disk atmosphere. These findings complement previous indications of flatter disk structures and longer disk lifetimes around cool stars.

Results: Our results highlight important differences in the chemical and physical evolution of protoplanetary disks as a function of stellar mass, temperature, and radiation field that are expected to strongly influence planet formation. The prominent difference in the detection rate of nitrogen-bearing simple organic molecules around cool stars and sun-like stars is likely the result of the major difference in the UV–luminosity of the two types of stars. We note, that the different chemistry of preplanetary materials in the disk may also influence the bulk composition and volatile content of the forming planets. In particular, if exogenous HCN has played a key role in the synthesis of prebiotic molecules on Earth as proposed, then prebiotic chemistry may unfold differently on planets around cool stars.