

# Challenges for understanding dust in planetary systems

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It is ironic that the first planetary material imaged around another star consisted of micron-sized dust particles, but dust remains a critical pathway to understanding the formation and evolution of planetary systems thirty-five years after the debris disk of  $\beta$  Pictoris was first imaged in visible light. As astronomers are poised to routinely image planets around nearby stars in reflected light, several challenges remain in our fundamental understanding of dust that may help or hinder humanity's search for another Earth-like planet. I will review two particular challenges that span the full lifetime of planet-hosting stars: understanding the chemistry of planetary systems as revealed in scattered light and in the dust of dead planetary systems and predicting the typical brightness of dust in the terrestrial planet forming region. I will also discuss how future space-based observatories will solve some of these persistent mysteries—while raising new questions.