Il Colle di Galileo

iSEEDS: 1.3 Million to Unveil the Chemistry of Young Disks at the Arcetri Astrophysical Observatory

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Abstract. The iSEEDS (astrochemIcal Study of Early Embedded DiskS) project has received €1.3 million in funding by the Italian Ministry of University and Research (MUR) through the Fondo Italiano per la Scienza (FIS 2). The project aims to investigate the physical and chemical properties of protostellar disks - the birthplace of planetary systems - with the ultimate goal of constraining the initial conditions for planet formation.

Keywords: astrochemistry, protostellar disks, planet formation, data science.

iSEEDS will study young disks, less than one million years old and still embedded within their parent molecular clouds, to uncover the earliest phases of planetary system formation—similar to our own Solar System. The project will address fundamental questions such as:

1. How much mass is available in the disk for planet formation?
2. What chemical composition is inherited by forming planets?
3. When and how do dust grains grow into planetesimals?

iSEEDS will adopt an innovative, interdisciplinary approach—combining astrochemistry, data mining, and machine learning—to develop new tools capable of fully exploiting the vast datasets generated by modern telescopes.

The project is organised into three main research lines, focusing respectively on determining disk mass, chemical composition, and dust properties. The iSEEDS team will carry out the research and develop the infrastructure needed to collect and analyse the data.

iSEEDS will be conducted in collaboration with the INAF-OAA astrochemistry group, which has a long-standing tradition in studying the chemistry of the early stages of solar-type star formation and its connection to primitive Solar System objects.

The Principal Investigator, Eleonora Bianchi, is a staff researcher at INAF–OAA. She graduated from the University of Bologna and earned her Ph.D. in Physics and Astronomy at the University of Florence, conducting her thesis research at INAF-OAA within the astrochemistry team. She has held postdoctoral

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positions in France at the Institut de Planétologie et d'Astrophysique de Grenoble and in Germany as a Vera Rubin Fellow at the ORIGINS Excellence Cluster.

Since July 2024, she has been a staff researcher at INAF-OAA, initially funded by the PRIN-MUR 2022 project *"Chemical Origins"*, and subsequently by the PNRR project *"STILES: Strengthening the Italian Leadership in ELT and SKA"*. Beginning in October 2025, she will work full-time on the iSEEDS project, coordinating a team of five researchers.