CSST 暗物质粒子性质 2025

Report of Contributions

https://indico.pmo.ac.cn/e/1003

Contribution ID: **16** Type: **not specified**

孤立的暗物质缺失矮星系

Saturday 25 October 2025 09:00 (45 minutes)

在标准宇宙学中，暗物质推动了星系的结构形成，并构建了形成星系的势阱。在大质量星系团中，暗晕中的重子物质比例将将达到宇宙平均值（15.7%），重子物质比例随着系统质量的降低而迅速减少。在矮星系中暗物质的质量占主导地位，即使在其光半光半径内（re≈1 kpc）仍然是暗物质主导。然而，最近有研究发现并非所有的矮星系都是由暗物质主导的，我们也发现了 19 个暗物质缺失的矮星系（dark-matter-deficient dwarf galaxies DMDGs），它们在远大于 re 范围内主要由重子物质组成，这与标准宇宙学预言的矮星系应为暗物质主导相悖。从流体力学模拟中对这种矮星系的研究表明，星系在高密度区域的相互作用以及环境剥离是形成重子物质主导矮星系的原因。然而要解释孤立环境中 DMDG（14/19）的形成和演化更具有挑战性，因为其形成和演化不受环境影响，目前我们的标准宇宙学无法解释重子物质主导矮星系是如何形成的。这样的系统对目前的星系形成理论提出了挑战，也为暗物质的本质提供了新的线索（例如，温暗物质、模糊暗物质、自相互作用暗物质或 MOND）。

Presenter: Prof. 胡, 慧杰 (安庆师范大学)

Session Classification: Session 1 （每个报告：30 分钟个人报告 +15 分钟讨论）

Contribution ID: **17** Type: **not specified**

Dwarf galaxies as dark matter probes with CSST

Saturday 25 October 2025 09:45 (45 minutes)

Presenter: Prof. 袁, 珍 (南京大学)

Session Classification: Session 1 （每个报告：30 分钟个人报告 +15 分钟讨论）

Contribution ID: **18** Type: **not specified**

Dark matter annihilation signals from the possible faintest dwarf satellite galaxy

Saturday 25 October 2025 11:00 (45 minutes)

Presenter: Prof. 殷, 鹏飞 (高能物理研究所)

Session Classification: Session 1 （每个报告：30 分钟个人报告 +15 分钟讨论）

Contribution ID: **19** Type: **not specified**

一个具有异常高聚集度暗物质晕的并合矮星系遗迹

Saturday 25 October 2025 13:15 (45 minutes)

Presenter: Dr 李, 孚嘉 (中国科学技术大学)

Session Classification: Session2 （每个报告：30 分钟个人报告 +15 分钟讨论）

Contribution ID: **20** Type: **not specified**

The central regions of galaxies as the probe of dark matter: astrophysical uncertainties

Saturday 25 October 2025 14:00 (45 minutes)

Presenter: Prof. 李, 辉 (清华大学)

Session Classification: Session2 （每个报告：30 分钟个人报告 +15 分钟讨论）

Contribution ID: **22** Type: **not specified**

Constraining the properties of dark matter by astronomical observations

Saturday 25 October 2025 16:00 (45 minutes)

Presenter: Prof. 毕, 效军 (高能物理研究所)

Session Classification: Session3 （每个报告：30 分钟个人报告 +15 分钟讨论）

Contribution ID: **23** Type: **not specified**

Beyond Collisionless Cold Dark Matter: Observational Clues to Self-Interacting Dark Matter

Saturday 25 October 2025 17:30 (45 minutes)

Cold dark matter (CDM) has been remarkably successful in describing the large-scale universe, yet tensions persist on smaller scales —from dwarf galaxy cores to the excess of galaxy–galaxy strong lensing (GGSL) anomalies in clusters. These discrepancies point to limitations in the collisionless CDM paradigm. In this talk, I will focus on self-interacting dark matter (SIDM), and in particular a two-component model with mass segregation, which offers a unified explanation for both dwarf-scale cores and GGSL anomalies. These observational clues underscore the power of lensing and other astrophysical probes in revealing the microphysics of the dark sector.

Presenter: Dr 侯, 思媛 (紫金山天文台)

Session Classification: Session3 （每个报告：30 分钟个人报告 +15 分钟讨论）

Contribution ID: **24** Type: **not specified**

Baryon-Dominated Dwarf Galaxy Enhanced by Weakened Gravitational Binding in Galaxy Collisions

Sunday 26 October 2025 09:00 (45 minutes)

Baryon-dominated dwarf galaxies (BDDGs) can emerge from high-velocity collisions between gas-rich ultra-diffuse galaxies. Using hydrodynamical simulations with progenitors of contrasting gravitational binding energies, we show that progenitor structure critically regulates BDDG formation. Specifically, collisions involving more weakly bound progenitors sustain star formation longer and yield more massive BDDGs, whereas tightly bound progenitors experience stronger tidal winds that preferentially produce multiple low-mass remnants. While both bursty stellar feedback and elastic self-interacting dark matter can generate cored halos, only feedback injects energy and boosts the BDDG formation. Our results position collisional BDDGs as a novel probe of feedback-regulated galaxy formation and dark matter physics. Upcoming wide-field imaging (CSST, LSST), HI surveys (FAST), and kinematic follow-up will be crucial for identifying candidates and testing these scenarios.

Presenter: Prof. 杨, 大能 (紫金山天文台)

Session Classification: Session 4（每个报告：30 分钟个人报告 +15 分钟讨论）

Contribution ID: **25** Type: **not specified**

The dark matter content of Milky Way dwarf spheroidal galaxies: Draco, Sextans and Ursa Minor

Sunday 26 October 2025 09:45 (45 minutes)

The Milky Way Survey of the Dark Energy Spectroscopic Instrument (DESI) has so far observed three classical dwarf spheroidal galaxies (dSphs): Draco, Sextans and Ursa Minor. Based on the observed line-of-sight velocities and metallicities of their member stars, we apply the axisymmetric Jeans Anisotropic Multi-Gaussian Expansion modeling (JAM) approach to recover their inner dark matter distributions. In particular, both the traditional single-population Jeans model and the multiple population chemodynamical model are adopted. With the chemodynamical model, we divide member stars of each dSph into metal-rich and metal-poor populations. The metal-rich populations are more centrally concentrated and dynamically colder, featuring lower velocity dispersion profiles than the metal-poor populations. We find a diversity of the inner density slopes of dark matter halos, with the best constraints by single-population or chemodynamical models consistent with each other. The inner density slopes are 0.71, 0.26 and 0.33 for Draco, Sextans and Ursa Minor, respectively. We also present the measured astrophysical J and D factors of the three dSphs. Our results indicate that the study of the dark matter content of dSphs through stellar kinematics is still subject to uncertainties behind both the methodology and the observed data, through comparisons with previous measurements and data sets.

Presenter: Dr 杨, 皓 (上海交通大学)

Session Classification: Session 4（每个报告：30 分钟个人报告 +15 分钟讨论）

Contribution ID: **26** Type: **not specified**

Exploring the dark matter identity with strong strong lensing in CSST Era

Sunday 26 October 2025 11:00 (45 minutes)

Presenter: Prof. 李, 然 (国家天文台)

Session Classification: Session 4（每个报告：30 分钟个人报告 +15 分钟讨论）

Contribution ID: **34** Type: **not specified**

Detecting ultralight dark photon dark matter with precision stellar astrometry

Saturday 25 October 2025 14:45 (45 minutes)

Presenter: Prof. 袁, 强 (紫金山天文台)

Session Classification: Session2 （每个报告：30 分钟个人报告 +15 分钟讨论）

Contribution ID: **35** Type: **not specified**

The Preliminary Investigation of Low- Acceleration Gravitational Anomaly in Wide Binaries

Saturday 25 October 2025 16:45 (45 minutes)

Presenter: Dr 陈, 豪然 (杭州电子科技大学)

Session Classification: Session3 （每个报告：30 分钟个人报告 +15 分钟讨论）