Astronomy Special Seminar

李政道研究所
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A new parallelized numerical scheme for radiative transfer calculations in three dimensional distributions

Time: 14:00-14:15, 18 June (Tuesday), Shanghai time

Venue：N601（TDLI）

Host: Yosuke Mizuno

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Meeting ID: 244698633 (Password:123456)

Abstract:

Radiative transfer is a computationally challenging task when it comes to three-dimensional high resolution simulations. It is needed to perform realistic astrochemical models with or without the inclusion of hydrodynamics. We present a fast and parallelized method for calculating the column density in different spatial directions in 3D space. Our method is based on the reverse ray-tracing method using a uniform Cartesian grid and the HEALPix scheme for emanating rays uniformly on the celestial sphere. The column density is calculated along each HEALPix ray and for each cell we then estimate a local column density averaged on a 4-pi solid angle. The accuracy and performance of our method are assessed in the case of a uniform-density sphere molecular cloud. The maximum relative error of the averaged column density between our method and theoretical solution less than 2×10-4. The distributed parallel strategy achieves an efficiency of around 90% with 2048 ranks. These results demonstrate that our method is accurate and efficient enough to calculate the column densities, making possible to calculate the three-dimensional escape probability for astrochemical modeling.

Biography:

Dr. Zhengping Zhu (朱正平) is an assistant researcher in Astronomical Computing Research Center of Zhejiang Laboratory. He received his PhD degree in computational fluid mechanics supervised by academician Xiaojing Zheng from Xidian University in 2022. And he is supervised by Prof. Lian Shen at the University of Minnesota as a visiting scholar in 2019. His main interests are parallel computing, interstellar medium, particle-laden turbulence, and his research results have been published in International Journal of Multiphase Flow and Journal of Fluid Mechanics.