第37回
RESCEU コロキウム

東京大学大学院理学系研究科 附属ビッグバン宇宙国際研究センター

日　時:　2019 年 4 月 4 日(木) 13:30 ～14:30

場　所:　理学部 4 号館 1 階ピロティ RESCEU セミナー室

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The Origin of the X-ray Clumpy Ejecta in Type Ia Supernova Remnants

X-ray-emitting clumpy structures are generally observed in young Type Ia supernova remnants although the origin is still obscure. There are two candidates for explaining the formation of clumps; initial clumpiness in ejecta at the explosion (i.e., clumpy ejecta model) or hydrodynamic instabilities made from smooth ejecta profile (i.e., smooth ejecta model). This information should reflect the initial ejecta structure of SNe Ia, so it is important for understanding the Type Ia explosion itself. Our preliminary investigations into constraining the structure of SN Ia remnants using Fourier and wavelet-transform analyses did not turn out to be sufficiently powerful at discriminating the two hydro models and the observed Tycho image from each other. This led us to investigate an approach that would be more sensitive to patterns in the distribution of clumps and holes in the images, such as the "genus statistic."

In this study, for the first time, the genus statistics have been applied to a famous type Ia remnant, Tycho (SN 1572) to understand the formation of the clumps by comparing with hydrodynamical models (Sato et al. 2019, arXiv: 1903.00764). We found the genus curve from Tycho's supernova remnant strongly indicates a skewed non-Gaussian distribution of the ejecta clumps, which is similar to that of a hydrodynamical model for the clumpy ejecta model. In contrast, a hydrodynamical model for the smooth ejecta model has a genus curve that is similar to that of a random Gaussian distribution. Thus, our results support the initial clumpiness in the Type Ia ejecta is more reasonable for the origin of the clumps and demonstrate usefulness of the genus statistics for this field. In addition, we will also discuss the origin of "Fe-rich" ejecta clumps in Type Ia SNRs in this seminar.

興味をお持ちの方の聴講を歓迎致します。お茶とお菓子を用意しております。