

ICEHAP Seminar

Jan. 13, Tuesday, 2pm, 2015

place: Fac. of Sci. Bldg 2, 2F, room No.209

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"What is the "High-Velocity System"?"

abstract

Sixty years ago, Minkowski (1955) discovered an optical emission-line system projected northwest of the center and moving at a speed of ~ 3000 km/s towards NGC 1275, the central giant elliptical galaxy in the Perseus cluster. Subsequently referred to as the High-Velocity System (HVS), this object has since been recognized to be a star-forming disk galaxy. Other than that, however, the nature of the HVS and its physical relationship with NGC 1275 have remained a mystery: is the HVS a normal galaxy that simply happens to be superposed against NGC 1275, or is it a highly disrupted galaxy that is moving supersonically through the cluster core and possibly interacting with NGC 1275? A proper understanding of the HVS is crucial for separating its effects (if any) on the spectacular optical emission-line nebula and recent star formation in NGC 1275, both of which are thought to be related to an X-ray cooling flow.

Here, we present imaging spectroscopy of the HVS that resolves many of the outstanding questions posed about this galaxy. We show that the HVS is a distorted spiral galaxy that has a relatively low metallicity compared with normal spiral galaxies; furthermore, unlike the majority of these galaxies, the rotation curve of the HVS increases approximately linearly with radius, reaching a value of 200 km/s at 12 kpc. We show that the HVS is experiencing intense ram-pressure stripping, affirming that it is indeed located in the Perseus cluster. The HVS exhibits a recent star-formation rate of $3.6 M_{\odot}/\text{yr}$, and formed numerous star clusters between 0.1 to 1 Gyr ago concentrated towards HII regions in this galaxy; these star clusters have different optical colors than those associated with NGC 1275, implying that the two populations are not coeval. The picture that we assemble for the HVS is that of a giant low-surface-brightness galaxy that fell into and is now closely approaching the center of the Perseus cluster; galaxy harassment or the strong cluster tidal field induced the formation of its two spiral arms along which intense star formation preferentially occurred. There is no direct evidence that the HVS is physically interacting with NGC 1275.