Hα Emission from Magellanic Stream

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Magellanic Stream is a long and narrow filament of neutral hydrogen gas which extends more than 180 degree around our Galaxy. It is thought to be a stripped gas from both of or one of the Magellanic clouds by their interaction. Most of the stream is observed as a neutral hydrogen gas [1], and no stars have been detected in it. Nevertheless, Hα emission is observed from some part of the stream [2,3], and the ionizing mechanism has been in debate.

We can expect that an optical intermediate-dispersion spectroscopic observation with a wide spectral coverage would be helpful to investigate the ionization sources. For example, as one of the hyposethes for the ionization, "shock cascade" model predicted a high Hβ/Hα ratio [4]. If we could measure the ratio from an observation, the models would be verified. The difficulty was, however, that the previous Hα observations used Fabry-Pérot spectrographs and the spatial information were averaged out. The spatial resolution was about 7 arcmin at most. The resolution is not enough for long-slit spectroscopy or multi object spectroscopy.

Aiming for breakthrough, we observed a 50 arcmin square region around one of the previous Hα detection in Hα narrowband and R-band filter using 2kCCD camera at the Kiso Observatory of the University of Tokyo in September and November in 2011 [5]. The exposure time corrected for the weather dimming was about 5 hours in total, and the limiting surface brightness was about 24 mag per square arcseconds as 1σ. We detected three parallel filamentary structures of Hα excess which lie a short distance away from a previous study (Fig. 1). The filaments are 2 arcminutes wide and 6−30 arcminutes long with 12 arcminutes intervals. Their position overlaps the neutral hydrogen stucture of the Magellanic Stream, but it also overlaps a nearby structure of hydrogen gas (Fig. 2).

If the Hα comes from a part of Magellanic Stream, it is qualitatively consistent with the shock cascade model; the surface of an upstream cloud is stripped by the interaction with the halo gas and then heated up by the collision with the following cloud at the downstream. If it is a nearby object, on the otherhand, it is difficult to make such a long, narrow and straight ionized gas structure. A possible explanation would be that several Fossil Strömgren Trails [6], a traveling white dwarf left its Strömgren sphere, were somehow created at the same direction from us. We will try to determine the recession velocity of the emission by spectroscopy and to answer whether they belong to Magellanic Stream ($v \sim -200$ km/s) or near by gas ($v \sim -40$ km/s).

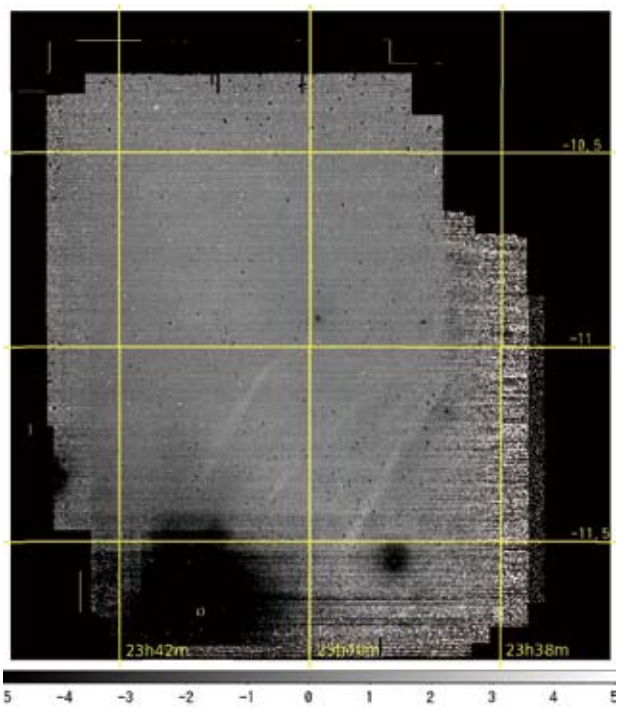

Figure 1: R-band subtracted N657 (Hα) image. Around the center, three parallel filamentary structures running from the top right to the bottom left direction are recognized.

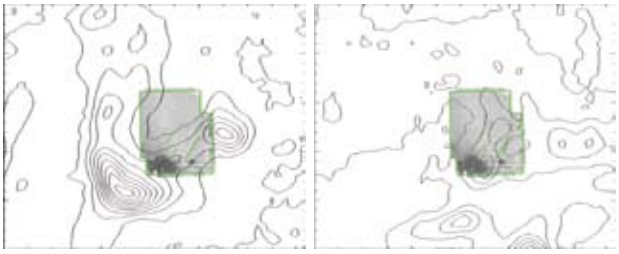

Figure 2: Hα emission overlaied on the contour of neutral hydrogen gas [7,8]. The left is the gas of Magellanic Stream, and the right is nearby Galactic gas.

References

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