# The Shortest Periodic and Flaring Activity of the 6.7 GHz Methanol Maser in the Intermediate-mass Protostar G 014.23–00.50

SUGIYAMA, Koichiro, HONMA, Mareki, UCHIYAMA, Mizuho, HACHISUKA, Kazuya, MATSUMOTO, Naoko
(NAOJ)

NAGASE, Katsura, YONEKURA, Yoshinori, MOMOSE, Munetake, YASUI, Yasutaka, SAITO, Yu
(Ibaraki University)

MOTOGI, Kazuhito, FUJISAWA, Kenta
(Yamaguchi University)

To statistically investigate the periodic flux variability of methanol masers at 6.7 GHz around protostars [1], we have initiated a single-dish monitor project using the Hitachi 32-m radio telescope since 30 December 2012 [2]. Target sources consist of 442 methanol masers, declination of which is upper than −30 deg. Here, we report the shortest periodic and flaring flux variability of the 6.7 GHz methanol maser newly detected in the intermediate-mass protostar G 014.23–00.50 via the monitor until 21 January 2016 [3].

The 6.7 GHz methanol maser in G 014.23–00.50 shows seven spectral components at $V_{\rm lsr}$ = 20.98–25.30 km s$^{-1}$. We newly detected characteristic flux variability in only one of them at $V_{\rm lsr}$ = 25.30 km s$^{-1}$, those are flaring and periodic one. The flaring activities were detected via comparing to non-detection durations below the detection limit ($3\sigma \sim 0.15$ Jy in the case of an integration with all the data in each observational date). Their time-scale of the flux rising was typically a few days or shorter (21 hrs at the shortest) and the ratio of the peak flux density was more than 180 in comparison with a quiescent phase (Figure 1). The periodicity of these flaring activities was also detected with the period of 23.9 ± 0.1 days, which has persisted in at least 47 cycles (Figure 2). This period is the shortest one observed in masers at around intermediate-/high-mass protostars so far.

We conclude that the flaring and intermittent periodic (the period of 23.9 days) flux variability detected in only one spectral component might be explained by a periodic change in the flux of seed photons or a periodic variation of the dust temperature via an extra heating source of a shock formed in the colliding-wind binary model [4], in which the orbital semi-major axes of the binary are 0.26–0.34 au.

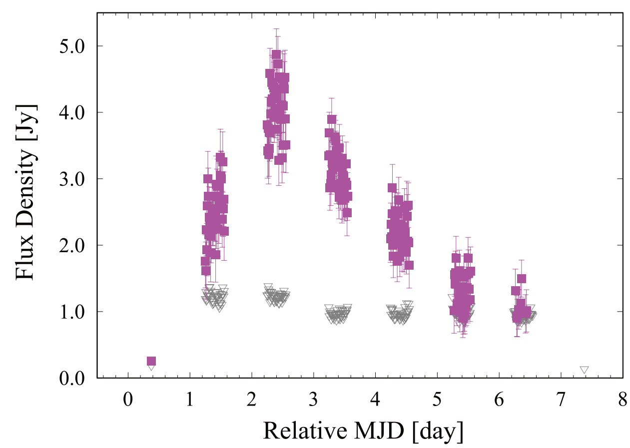


**Figure 1**: Example of the flaring activities detected at $V_{\rm lsr}$ = 25.30 km s$^{-1}$. The horizontal axis is observational dates relative to the reference date of 8 September 2015.

## References

[1] Goedhart, S., et al.: 2004, *MNRAS*, **355**, 553.
[2] Yonekura, Y., et al.: 2016, *PASJ*, **68**, 74.
[3] Sugiyama, K., et al.: 2017, *PASJ*, **69**, 59.
[4] van der Walt, D. J.: 2011, *AJ*, **141**, 152.

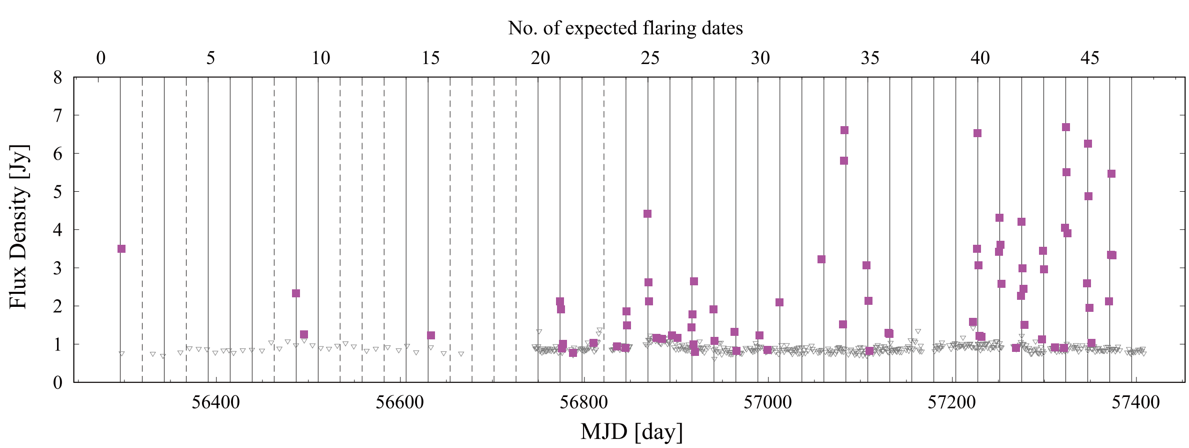


**Figure 2**: Periodic flux variation detected at $V_{\rm lsr}$ = 25.30 km s$^{-1}$. Solid and dashed vertical lines show the expected flaring dates with and without observational data.