4 years of 16-bands optical and infrared photometry of Betelgeuse with the Himawari-8 meteorological satellite (No 1708)

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SS22b : The Great Dimming of Betelgeuse: news from the mass loss of red supergiants

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Betelgeuse, one of the most studied red supergiants, dimmed in the optical by ~1.2 mag in late 2019 and early 2020; it is called "the Great Dimming". There are mainly two hypotheses proposed to explain the mechanism of the Dimming: the decrease in the effective temperature and the enhancement in the extinction caused by the newly produced circumstellar dust. Of the two scenarios, the decrease in the effective temperature has been confirmed with optical spectroscopy. In contrast, however, the enhanced dust production has yet to be confirmed, partly due to the lack of a long-term multi-wavelength monitoring, especially in the mid-infrared, where thermal emission from the circumstellar dust can be directly detected.
Here we present the 16-bands photometry of Betelgeuse in 0.45–13.5 ?m between January 2017 and December 2020 making use of the images taken by the Himawari-8 satellite, uninterrupted by the Sun even in summer. Comparing the optical and near-infrared light curves with the model SED of the photosphere, we show that both the decreased effective temperature and the increased dust extinction may contribute to the Great Dimming by almost the same amounts, ~0.5 and ~0.6 mag, respectively. Moreover, the light-curve at 9.64 ?m shows the enhancement in the dust emission during the Dimming, which directly proves the enhancement of the dust production. Finally, we found that Betelgeuse may, in fact, have changed its atmospheric structure 10 months before the Dimming; the circumstellar extinction started to increase, and, at the same time, the H?O molecular band suddenly changed from absorption to emission.