

First Results of Quadrantid Meteor Spectrum. Shinsuke Abe¹, Jiri Borovicka¹, Kouji Maeda², Noboru Ebizuka³, and Jun-ich Watanabe⁴, ¹Astronomical Institute of the Academy of Sciences(298 Fricova, Ondrejov 25165, The Czech Republic; avell@asu.cas.cz, borovic@asu.cas.cz), ²Physics of Electronic Materials Laboratory, University of Miyazaki(1-1 Gakuen Kibanadai Nishi, Miyazaki, 889-2192, Japan; maeda@pem.miyazaki-u.ac.jp), ³Institute of Physical and Chemical Research(Wako, Saitama 351-0198, Japan; ebizuka@riken.jp), ⁴National Astronomical Observatory of Japan, National Institutes of Natural Sciences(2-21-1 Osawa, Mitaka, Tokyo 181-8588, Japan; jun.watanabe@nao.ac.jp)

Introduction: The Quadrantid meteor shower is one of the most intense annual meteor shower which displays strong activities at the beginning of January with the zenithal hourly rate of ~100. The peak activity is quite short, being less than one night. Of particular interest is the question of a parent body of the Quadrantids, because it is the only major shower whose parent body is still in controversy. Recently, an asteroid 2003 EH1 has been discovered on an orbit that is so similar to that of the Quadrantid meteoroids[1]. However, the orbit still has some uncertainties. Comet C/1490 Y1, comet 96P/Machholz 1, asteroid 5496 (1973 NA) were also proposed for the candidate of the Quadrantids' parent body by [2,3,4], respectively. A part of a larger complex of the Quadrantid meteoroids should have relationship with the daytime Arietid and the southern Delta Aquarid showers that could have formed as recently as 2200 years ago resulted from the perturbing effects of close encounters with Jupiter[5]. Because the orbit of the Quadrantid meteoroids approaches to many planets as well as Jupiter, it is hard to calculate its orbital evolution; e.g., the orbit of the 1987 Quadrantids was significantly different from that of the standard Quadrantids due to strong perturbation as a result of close encounter with Jupiter in 1984[6]. At this juncture, various possibilities of the Quadrantids' parent are discussed[7].

Though the declination of the Quadrantids radiant, $d=50^\circ$, is convenient position for the observation from the Northern hemisphere, the weather in January in the Northern hemisphere usually discourage observing and this fact combined with narrow activity peak means that high quality spectroscopic observations have not been done until today[8]. In this paper, we shall focus on the physical properties of the Quadrantid meteoroids by means of several high quality spectra and discuss about characteristics of its parent body.

Observations and Results: During the 2003 Quadrantids maximum, spectroscopic observations were carried out using Image-Intensified CCD cameras (ICCDs) in the visible, and near-infrared wavelength regions (400-930 nm) with objective 600 grooves/mm gratings. The ICCD system provided a circular field of view of $\sim 26^\circ$ in diameter. The spectrum was recorded by NTSC with Hi8 or PAL with SVHS standard. The spectra analyzed here are 4 sets of high

quality data, 3 of them were observed in Miyazaki pref., Japan and 1 of them in Ondrejov observatory, Czech Republic. One of the most interesting signature of the Quadrantid meteoroids resulted from the differential ablations of sodium. Na emission appeared earlier than other metal atoms such as Mg and Fe. The effect of sodium early release is also strong in the Leonids (parent body; comet 55P/Tempel-Tuttle), Orionids (comet 1P/Halley) and Leo Minorids. On the other hand, it is much weaker in Perseids (comet 109P/Swift-Tuttle) and no sodium preferential ablation was observed in Geminids (asteroid (3200) Phaethon), Taurids (comet 2P/Encke) and the Ursa Minorids (comet 8P/Tuttle). It seems reasonable to suppose that dust-ball-meteoroids grains originated from active comets, comet-asteroid transition objects (CATs) and very young distinct comets are responsible for differential ablations. We will discuss about properties and abundances of the Quadrantid meteoroids in detail.

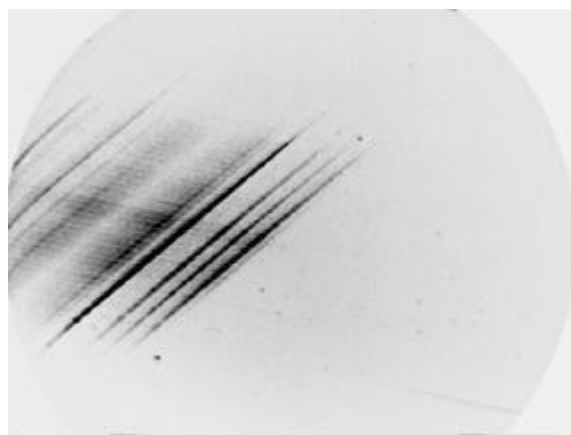


Fig. 1. Example spectrum of the Quadrantid meteor.

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