

# Analysis spectral and dynamic of the Meteor on August 21<sup>st</sup>, 2018 in São Paulo

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**Abstract.** On August 21<sup>st</sup>, 2018 at 05:23:02 UTC, six stations recorded the same meteor. It was very bright and was able to generate a very bright spectrum which could be analyzed. The pairing allowed to determine the trajectory of the object, being the fragment of space rock that reached the atmosphere at a speed of 17.9 Km / s (more than 64 thousand Km / h) with 82.4 km altitude, over Santa Isabel (Lat: -3,355, Log: -46,233). It went northwest in a very bright glow until it reached an altitude of 42.2 km over Piracaia (Lat: -23.056, Long: -46.386). It was recorded by cameras in Osasco, Sumaré, Guaratinguetá and Nhandeara in São Paulo, and in Oliveira and Maria da Fé in Minas Gerais. It had a duration of 1.8s, entry angle 48.2°, absolute magnitude of -6.3, straight rise of 38.7° and declination: -58.8°. Being the Right Ascension and Declination related to the moment when the meteor hits Earth. From the spectrum recorded with 66 frames, it is observed that in its evolution initially had a peak of FeI, CaI, then NaI, OI, MgII and in the end only FeI, supposing that it is a ferrous object.

**Resumo.** No dia 21 de Agosto de 2018 às 05:23:02 UTC, seis estações registraram o mesmo meteoro. Ele foi muito brilhante a ponto de gerar um espectro bastante luminoso, o qual pode ser analisado. O pareamento permitiu determinar a trajetória do objeto, sendo que o fragmento de rocha espacial atingiu a atmosfera a uma velocidade de 17.9 Km/s (mais de 64 mil Km/h) a 82.4 km de altitude, sobre o município de Santa Isabel (Lat: -23.355°, Log: -46.233°). Seguiu na direção noroeste mantendo o brilho intenso até atingir a altitude de 42.2 km sobre o município de Piracaia (Lat: -23.056°, Long: -46.386°). Ele foi registrado por câmeras em Osasco, Sumaré, Guaratinguetá e Nhandeara, em São Paulo, e em Oliveira e Maria da Fé, em Minas Gerais. O fenômeno possuiu uma duração de 1.8s, ângulo de entrada de 48.2°, magnitude absoluta máxima de -6.3, e se originou em um ponto de coordenadas: Ascensão Reta = 38.7° e Declinação = -58.8°. Sendo a Ascensão Reta e Declinação relacionada ao momento em que o meteoro atinge a Terra. A partir do espectro registrado com 66 frames, observa-se que em sua evolução inicialmente teve pico de FeI, CaI, depois NaI, OI, MgII e no final apenas o FeI, supondo assim, tratar-se de um objeto ferroso.

**Keywords.** Astrometry – Meteor – Spectroscopic

## 1. Introduction

Meteors are atmospheric phenomena that draw much attention from people as well as the scientific community in view of their physical, chemical and dynamic characteristics. The possibility of recording such a phenomenon and making a more accurate study led to the implementation of a meteorite monitoring station (Izacson, C., Coelho, A., Jacques, C. 2008). On August 21<sup>st</sup>, 2018 at 05:23:02 UTC, Six stations recorded the same meteor, among them WSR1 located in Maria da Fé-MG, represented in 1.



**FIGURE 1.** Meteor registered by station WSR1.

This meteor caught the eye because it was very bright and because one of the six stations had a large diffraction in its camera eyepiece. Being able to study more characteristics of the meteor.

## 2. Methodology

For the records, cameras and low cost equipment are used. To obtain the composition through spectroscopy was used diffraction grid of 500 mm / lines in front of the cameras and thus obtaining the meteor spectrum. In this event, we used data from ADJ1 cameras in Osasco-SP, FGL1 in Sumaré-SP, GDOP1 in Guaratinguetá-SP, RCP1 in Nhandeara-SP, WMV1 in Oliveira-MG and WSR1 in Maria da Fé-MG. All stations are part of the Brazilian Meteor Observation Network (BRAMON) (Amaral et al., 2017). For meteor capture, UFOCapture software was used, for single analysis UFOAnalyzer and for orbital UFOOrbit (Sonotaco, 2009). For analysis of possible parental body we used the software Encontreitor (Amaral et al., 2017). For spectral analysis, Real-time Spectroscopy (Rspec) (Field, 2011). Only station GDOP1 had a diffraction grating.

## 3. Results and discussions

The pairing of observations also allowed to determine the trajectory of the object, and the fragment of space rock that hit the atmosphere at a speed of 17.9 Km/s (over 64 thousand Km/h) with 82.4 km of height, about the Municipality of Santa Isabel (Lat: -23.355, Log: -46.233). It headed northwest with a very intense glow until it reached the height of 42.2 km over Piracaia (Lat: -23.056, Long: -46.386). It had a duration of 1.8s, entry angle 48.2°, absolute magnitude of -6.3, Straight Rise of

38.7° and Declination: -58.8°. Being the Right Ascension and Declination related to the moment when the meteor hits Earth. As shown in 2.



FIGURE 2. Meteor of trajectory.

In addition to this data, it was possible to generate its orbit shown in 1 shows its orbital elements and its orbit in 3.

Table 1. Orbital data of the meteor.

Classificação	e [-]	q [AU]	i [°]	$\omega$ [°]	$\Omega$ [°]
SPO	0.175	0.925	25.3	64.63	92.2

Since e the orbital eccentricity, q is the distance of the periastrum, i is the slope,  $\omega$  the periastrum argument and  $\Omega$  the ascending node. Its SPO classification was sporadic not pertaining to cataloged rain.

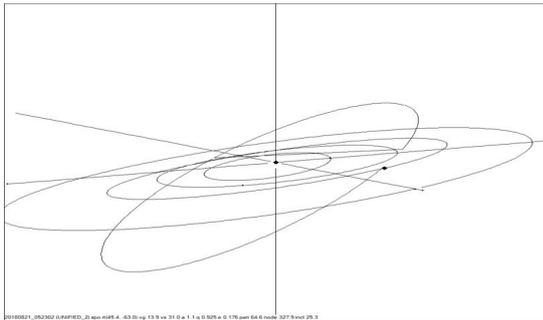


FIGURE 3. Meteor of orbit.

After analyzing its orbit, using the orbit criterion of (Drummond, J. D., 1981), choosing D from 0.04 to 0.08 and applying in the Finder it was not possible to find a parental body to this object, from those already discovered in the database Propulsion Laboratory (JPL).

From the recorded spectrum with 66 frames, it was possible to analyze frame by frame and observe how the meteor spectrum behaves. Represented in 4 below.



FIGURE 4. Meteor Spectrum Analyzed.

It is worth mentioning frame 59, where it was a frame before the meteor mass collapsed to be able to analyze its nearly full spectrum because it traverses the entire visible spectrum of the spectrum represented in 5 below.

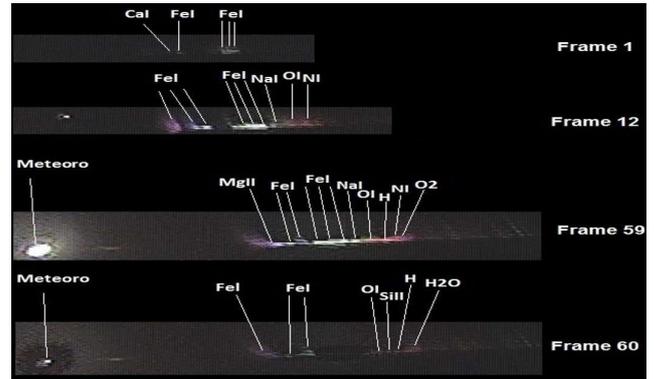


FIGURE 5. Spectrum Behavior During Meteor Passage.

It can be seen that to the extent that the meteor had a higher ablation, other compositions of its spectrum appeared and finally only the most predominant composition.

#### 4. Conclusions

From the calculated trajectory, the meteor came from the Clock Constellation direction and does not belong to any known meteor shower. From the spectrum recorded with 66 frames, it is observed that in its evolution initially had a peak of FeI, CaI, then NaI, OI, MgII and in the end only FeI, supposing that it is a ferrous object. The other compositions are caused by the Earth's atmosphere. The non-similarity of a parental body to the event turns on a warning signal, as the fragment generator may still be orbiting our solar system and thus another collision may occur again.

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