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The FRIPON Project or Pride and Prejudice in Citizen Science

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Abstract. FRIPON (Fireball Recovery and InterPlanetary Observation Network[1]) is a French project aiming to monitor the French skies 24 hours a day. FRIPON will detect meteors in order to estimate their orbit outside the atmosphere and to statistically determine possible parent bodies, as well as their trajectory inside the atmosphere to discover possible meteorites after the impact. A network of one hundred low-cost all-sky cameras is being installed all over France, coupled with radio receivers and spectroscopes. FRIPON will exploit data from other networks (seismographs, infrasound microbarometers) to increase chances of meteorite recovery and to improve the understanding of its properties. Data retrieving and analysis are automatized in order to minimize the time elapsed between meteor detection and field prospection. The project federates four research institutions although it is founded on the participation of a number of research laboratories, and cultural associations. Astronomers, geologists and engineers work together with a rich and already independently structured community of amateurs. FRIPON is a project where openness and transparency must cooperate with centralization and control, an example of the delicate balance between outreach, unavoidable to inspire proud people's involvement, and technical needs of scaling infrastructures aimed to produce valuable results.

1. The Project

FRIPON is a project aiming to watch French skies every day, 24 hours a day, in order to detect falling meteors (Colas et al. 2014; Zanda et al. 2015). Other networks are already in place in and outside Europe, managed by professionals or amateurs (e.g., Oberst 1998; Jenniskens et al. 2011; Bland et al. 2012; Roggemans et al. 2016). FRIPON is the first network completely based on open tools and protocols, some of which developed in house, implementing a high level of automatization from detection to science product generation. Openness and automatization are keys to reproducibility and data coherence.

1.1. Objectives

The main objective of FRIPON is to detect meteors in real time. The network computes the meteor trajectory; in the case of fireballs these computations imply a rapid recovery of potential meteorites. Reducing the time between the fall and the recovery will improve the quality of the sample and the quantity of information we can obtain from it. Following Brown et al. (2011), optical detections $\sim$ 100 km apart allow us to perform triangulation and determine the location of the fall with an accuracy better than one kilometer. The meteoroid orbit outside the atmosphere is also estimated: the density and coverage of the FRIPON network allow us to statistically determine possible parent bodies. FRIPON will exploit data from other networks (seismographs, infrasound microbarometers) to increase chances of meteorite recovery and to improve the understanding of meteorite properties. The link between the physical and chemical properties of fallen meteorites and their possible parent bodies will enlighten us about the origin of the Solar System.

1.2. Organization

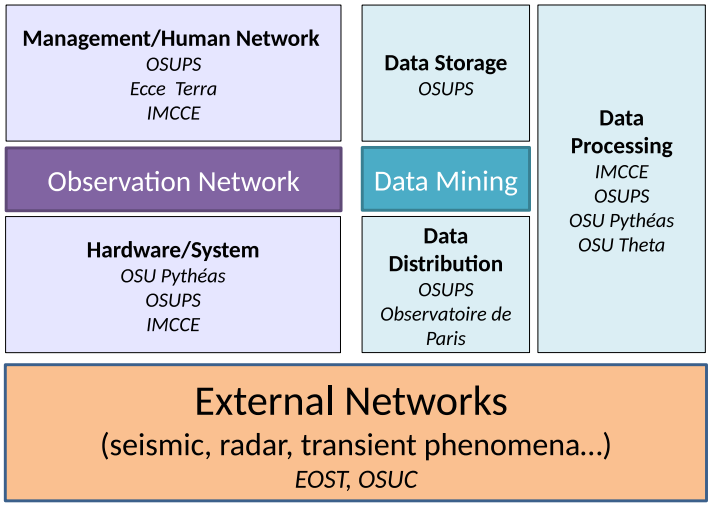

Figure 1. Distribution of Project Tasks

The project has been funded by the French ANR[2]. It has been initiated by five partners (Observatoire de Paris, Paris Sud University, *Muséum National d'Histoire Naturelle*, Aix-Marseille University, CNRS) and it is attracting contributions from the whole French Scientific community. FRIPON counts more than two hundred professional and amateur participants. Coherence and integrity of the information are essential in this kind of project, and they require strong centralization. On the other hand, the capillarity of the network requires an open and efficient distribution of information and duties.

1.3. Network Status

Seventy percent of the network of one hundred low-cost all-sky cameras is now operational. Radio receivers are under deployment (Rault et al. 2014). Spectroscopes are under development.

Both servers and clients run a vanilla Debian Linux operating system. The meteor detection software, FreeTure[3] (Audureau et al. 2014) has been released under the GNU GPL3 license and is available on GitHub[4]. The optical calibration pipeline is based on AstrOmatic software[5]. Orbit and trajectory computations rely on the Astropy[6] and SpiceyPy[7] Python libraries: routines are under validation for release.

The essential tools necessary for efficient information management (directory service, project management and system monitoring) have been deployed.

2. FRIPON and Citizen Science

FRIPON offers two levels of participation to citizens:

1. FRIPON station host - amateur observatories and cultural associations are official partners of the project;
2. Vigie-Ciel (Sky-Watch) participant - the sister project Vigie-Ciel (Colas et al. 2015) allows people to provide FRIPON with auxiliary data and help in looking for meteorites.

When people coming from different communities and having different work habits start to collaborate, inevitably, prejudices rise up. One amateur prejudice against professionals is information withholding, while professional prejudice against amateurs is often the lack of rigorous method. Both prejudices could be dispelled: improving scientific knowledge is a complex process and scientific institutions must assume their responsibilities in communicating about it. This way, researchers will feed the pride of the public to participate to the research process. Indeed, nothing fulfills the wish to be in the right place at the right time, like catching a falling star in the sky.

[2] *Agence Nationale de la Recherche*

[3] http://fripon.github.io/freeture/

[4] https://github.com/fripon/freeture

[5] http://astromatic.net

[6] http://www.astropy.org/

[7] http://spiceypy.readthedocs.io/

3. Perspectives

FRIPON has already started to build European connections. A collaboration has begun with the Belgian BRAMS radio network (Lamy et al. 2012). FRIPON will share solutions and human resources with the Italian network PRISMA. (Gardiol et al. 2016).

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References

Audureau, Y., et al. 2014, in Proceedings of the International Meteor Conference, Giron, France, 18-21 September 2014, edited by J.-L. Rault, & P. Roggemans, 39

Bland, P. A., et al. 2012, Australian Journal of Earth Sciences, 59, 177

Brown, P., et al. 2011, Meteoritics and Planetary Science, 46, 339

Colas, F., et al. 2014, in Asteroids, Comets, Meteors 2014, edited by K. Muinonen, A. Penttilä, M. Granvik, A. Virkki, G. Fedorets, O. Wilkman, & T. Kohout

— 2015, European Planetary Science Congress 2015, held 27 September - 2 October, 2015 in Nantes, France, id.EPSC2015-604, 10, EPSC2015-604

Gardiol, D., Cellino, A., & Di Martino, M. 2016, in Proceedings of the International Meteor Conference Egmond, the Netherlands, 2-5 June 2016, edited by A. Roggemans, & P. Roggemans, 76

Jenniskens, P., et al. 2011, Icarus, 216, 40

Lamy, H., et al. 2012, in European Planetary Science Congress 2012, EPSC2012

Oberst, J. 1998, Meteoritics and Planetary Science, 33

Rault, J.-L., Colas, F., & Vaubaillon, J. 2014, in Proceedings of the International Meteor Conference, Giron, France, 18-21 September 2014, edited by J.-L. Rault, & P. Roggemans, 185

Roggemans, P., Johannink, C., & Breukers, M. 2016, in International Meteor Conference Egmond, the Netherlands, 2-5 June 2016, edited by A. Roggemans, & P. Roggemans, 254

Zanda, B., et al. 2015, in 78th Annual Meeting of the Meteoritical Society, vol. 1856 of LPI Contributions, 5296