

Nature of impact flashes

International Impact monitoring network



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IMCCE

Introduction

- ☾ Before 1960, 570 unusual phenomena on the Moon observed in 5 centuries by 300 people
- ☾ Apollo mission → ~ 300 impacts/year recorded on the surface of the Moon with seismometers

Is that possible to observe these impacts from the Earth?

YES, 23 flashes observed during Leonids
1999

Marshall Space Flight center

since 11/ 2005, detection of 207 flashes

→ Confirmation of the Impact origin

→ Nature of the flash?

→ How to detect more flashes?



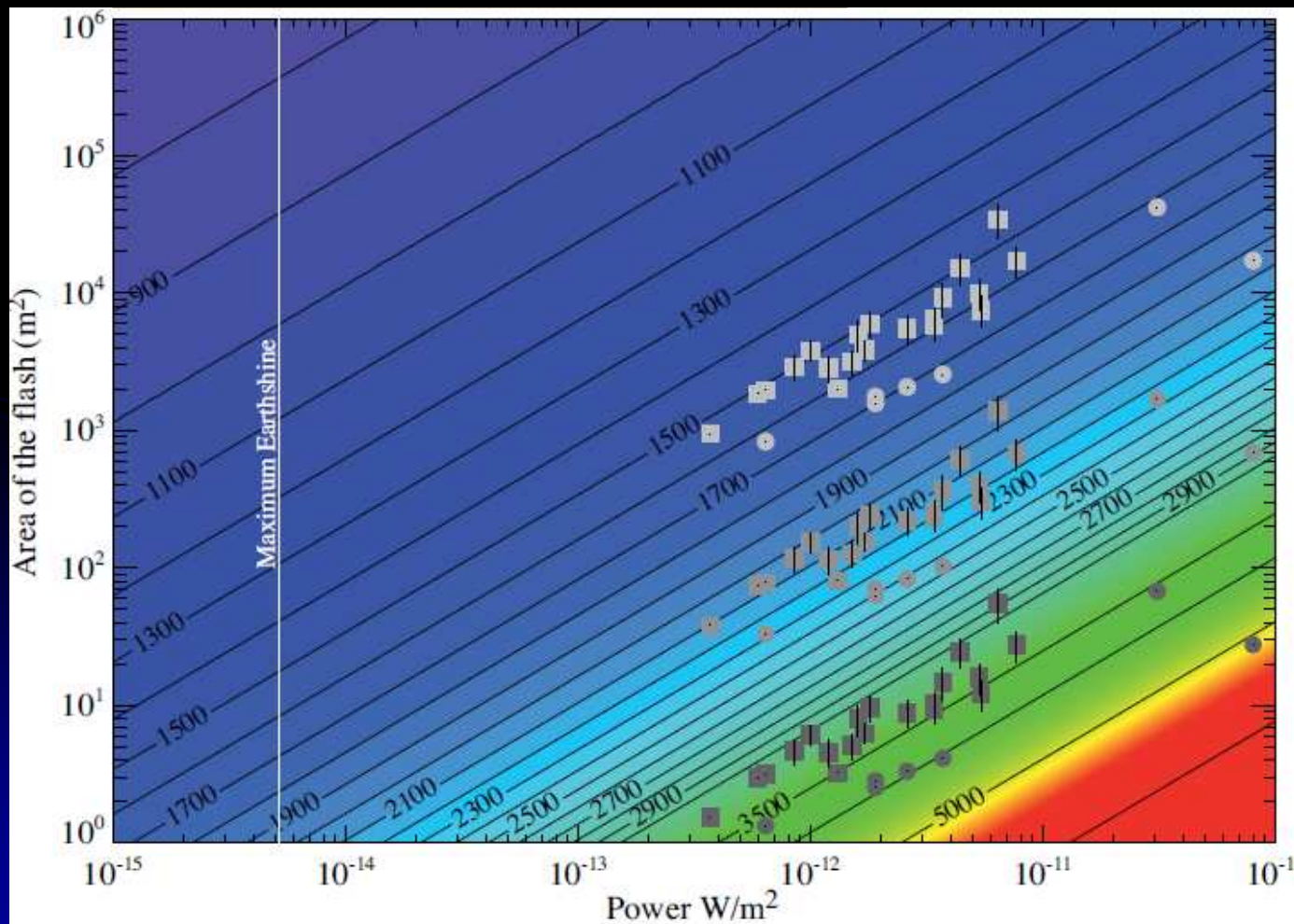
Ortiz et al, 2006

Nature of lunar flashes

Size: ~cm \rightarrow ~ 10cm / Origin: sporadic and main meteoric swarms

54 flashes in the literature with magnitude and duration

Estimation of the Brightness Power, Energy liberated and the diameter of the new crater

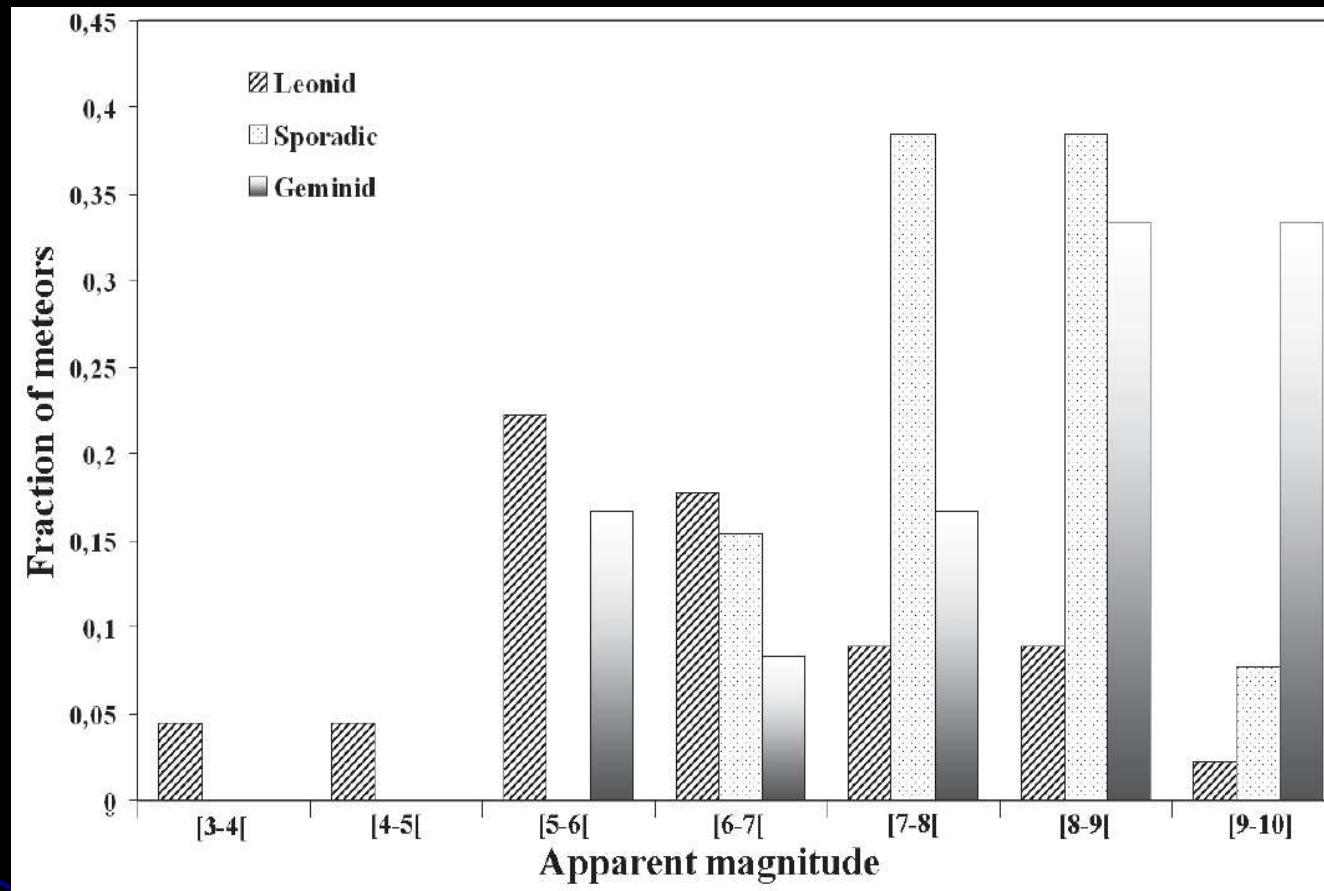


☾ Temperature range:
1500 to 3000 K

☾ Melting point of the
silicates

\rightarrow a cloud of liquid
silicates droplets ejected
during the impact

How to observe more flashes?



→ Magnitude of the flash from 3 to 10 depending of the impact velocity (20 à 75 km/s)

→ Observation of flashes in IR in the future (2011)

→ Detection of flash during moon phase > 50% illumination

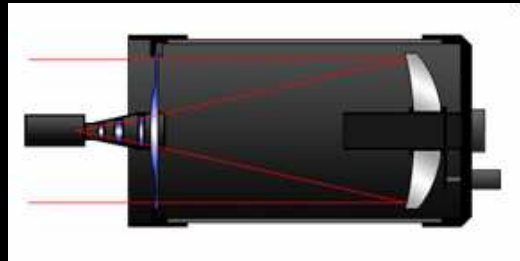
→ Use of faster cameras (>100 fps) (2011)

→ **Creation of an international network**

Global Detection

5 observatories ready to observe

Telescope



C14 (355mm) + Hyperstar System
Focal of the system: 690 mm f/d 1.9
+ 200/800 telescope

Camera and field of view

Watec Camera (902H2, 120N)

50 fps

Field of view: 30' × 19'

Resolution: 5km/pixel



Automatic detection with UFO
capture software

Stations in France



**Uranoscope de l'Île France
(Close to Paris)**

One Mobile station in South of France)



Stations in Morocco



Oukaimden Observatory

High Atlas

Altitude 2700 m

Moroccan Observatories

→ 100% dedicated to flash monitoring from the last to first moon quarter

→ Operated by Moroccan PhD Student and scientists (Z. Benkhaldoun)

Marrakech Observatory

3.5 dome+C14



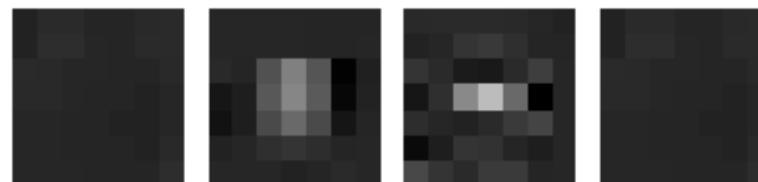
Station in Mongolia

Date : 01/09/2010

Time : 17 :24m 17s UT

Duration : 40ms

Approximative location : 11°E 38°S



International Impact monitoring network



International network

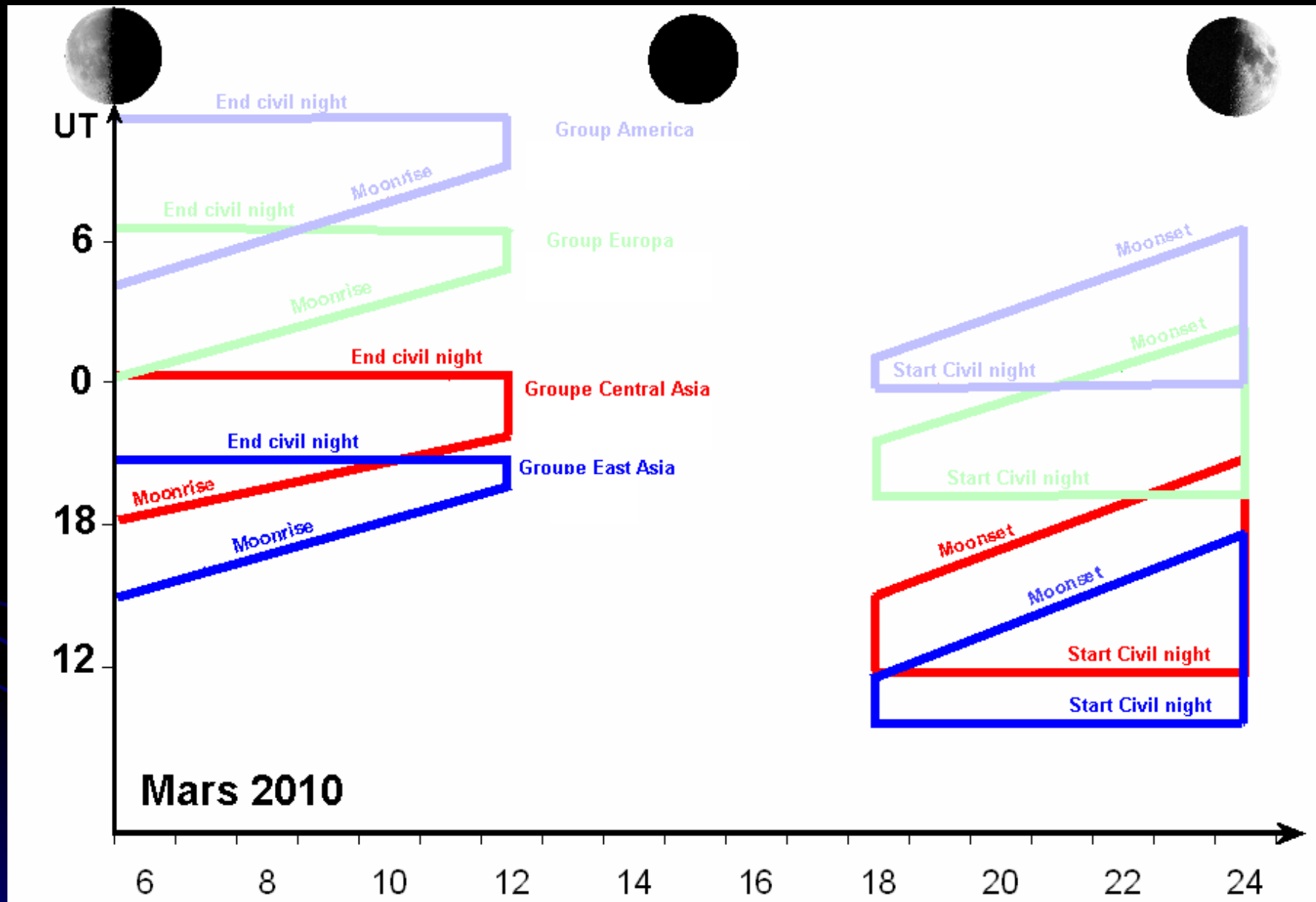
America: Panama (in 2011), Chile (in 2012), USA (Marshall)

Europe: France (Ready), Morocco (Ready),

Central Asia: Mongolia (Ready), Tadjikistan (2011), India (in 2012)

Eastern Asia and Oceania: Japan (2013) and New Zealand

International Impact monitoring network



→ Increase of observation time by 4

Conclusion

Objectives until 2014

- 🌐 Network of 10 double stations with fixed short focal Telescopes around the world for global detection
- 🌐 Development of an European amateur telescope network
 - Different focal length and diameter
 - Mosaic of fields of view with high resolution location (long focal telescopes)

Science objectives

- 🌐 Flash modeling
- 🌐 *Determine impact flux and the dependency between impact flux and the position.*
- 🌐 *Correlate flashes positions with seismic recording of moonquakes (Selene2, Lunette, ILN)*
 - *Internal structure of the moon*
 - *Link the different seismic parameters (Energy, Magnitude) with crater morphology (Diameter, Depth) with High Resolution images*

