EARS, MARS combined radio observations - 2014

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The Lyrids meteor shower was generated on 21-22 April 2014 by the passage of the Earth through the path of the debris of the comet C/1861 G1 (Thatcher). The Camelopardalids meteor shower was generated on 23-24 May 2014 by the passage of the Earth through the path of the debris of the comet 209P/Linear. The EurAstro Radio Station (EARS) and the Malta Astro Radio Station (MARS) were operated in parallel for two combined radio observation campaigns. The campaigns revealed that further combined radio observation campaigns are necessary to solve the problem of estimating the number of lost radio meteor echoes.

1 Introduction

The Lyrid meteor shower was generated on 21–22 April 2014 by the passage of Earth through the path of the debris of the comet C/1861 G1 (Thatcher).

The EurAstro Radio Station (EARS), based on the forward scattering principle and operated by myself, adopted the following configuration: radio beacon from radar Graves (emitter at Broyes-les-Pesmaes, 47°20'51.72" N, 5°30'58.68" W, about 500 Km from Munich)[1], vertical antenna J-Pole 144[2], receiver ICOM 1500 (USB mode, 143,049 MHz), computer Pavillion dv6 (processor Intel Core Duo T2500) and SpecLab V26 b10 (Tomezzoli, 2014).

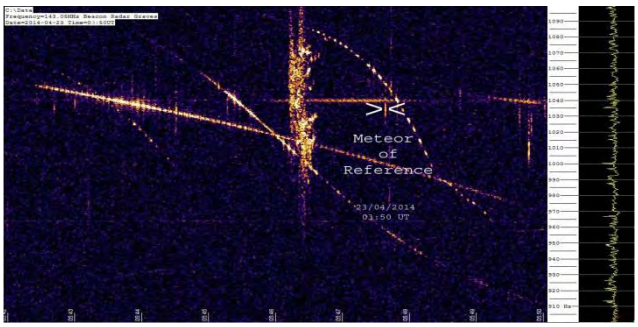


Figure 1 – EARS - Lyrids 2014 – 23/04/2014, 03^h50^m U.T. - airplane radio echoes (arcuate traces), overdense radio echo in the middle, underdense radio echoes and underdense reference meteor echo.

In order to catch the maximum of the Lyrids 2014, the EARS radio recording was started on 21 April 2014 at 15^h00^m UT and stopped on 24 April 2014 at 03^h50^m UT. For the first time, EARS and the Malta Astro Radio Station (MARS) operated by Alexei Pace worked in parallel for a combined radio observation campaign, in order to provide a cross check of the results. The presence in the past EARS JPG images of conspicuous airplanes radio echoes (Figures 1 and 2, arcuate traces) advised me against the use of an automatic meteor counting program because it is generally known that such programs are "confused" by airplane radio-reflections.

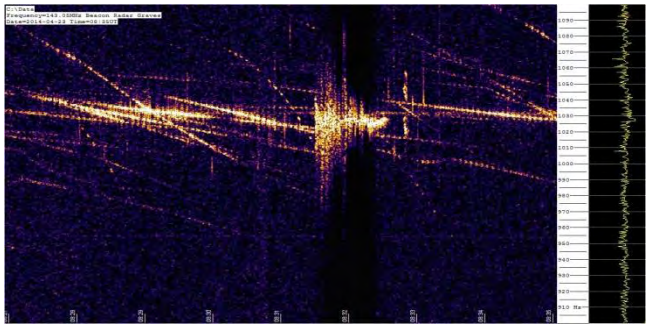


Figure 2 – EARS - Lyrids 2014 – 23/04/2014, 06^h35^m U.T. - airplane radio echoes (arcuate traces), overdense radio echo in the middle and underdense radio echoes.

2 Lyrids 2014

MARS Results

MARS, because of its distance (about 1500 Km) from the Graves radar emitter, is not influenced by airplane radio reflections (Figures 3 and 4). Therefore, an automatic meteor counting program was used. The configuration of MARS and the results of the MARS radio observations of the Lyrids 2014 are summarised in Figures 5 and 6.

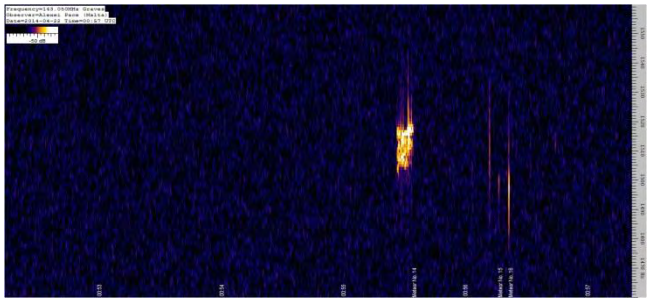


Figure 3 – MARS - Lyrids 2014 – 22/04/2014, 00^h57^m UT, overdense radio echo in middle right and three underdense radio echoes on the right.

[1] http://fr.wikipedia.org/wiki/Radar_GRAVES
[2] http://www.antennepkw.com/1/j_pole_326922.html

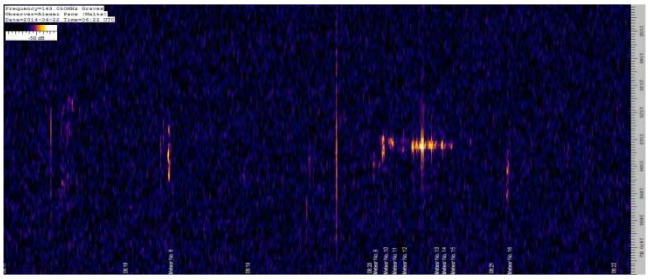


Figure 4 – MARS - Lyrids 2014 – 22/04/2014, 06^h22^m UT, two overdenses radio echoes in the middle right and underdense radio echoes on the left and on the right.

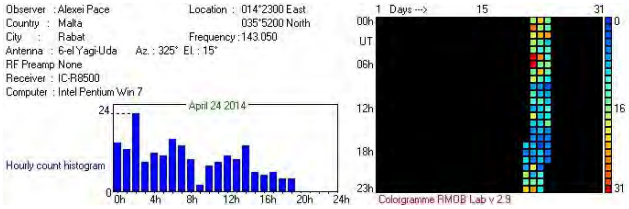


Figure 5 – MARS position, configuration and radio observation colorgramme.

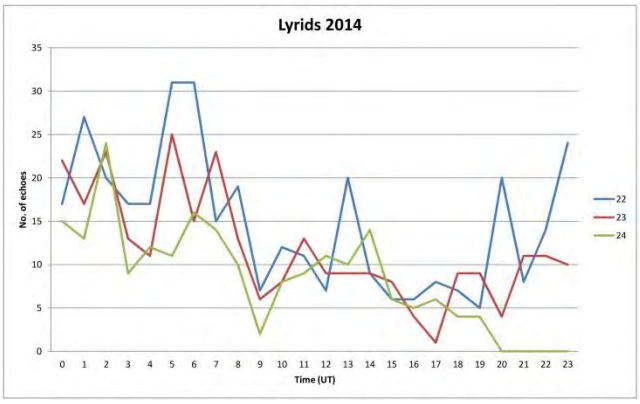


Figure 6 – MARS – Lyrids 2014 counting details.

Discussion

EARS (Figure 7) recorded a double maximum for the Lyrids 2014 superimposed on the background of the sporadic meteors. A first maximum (Figure 7, better indicated by the overdense radio echoes) on 22/04/2014 between 03^h00^m – 10^h00^m UT and a second maximum (Figure 7, better indicated by the overdense radio echoes)

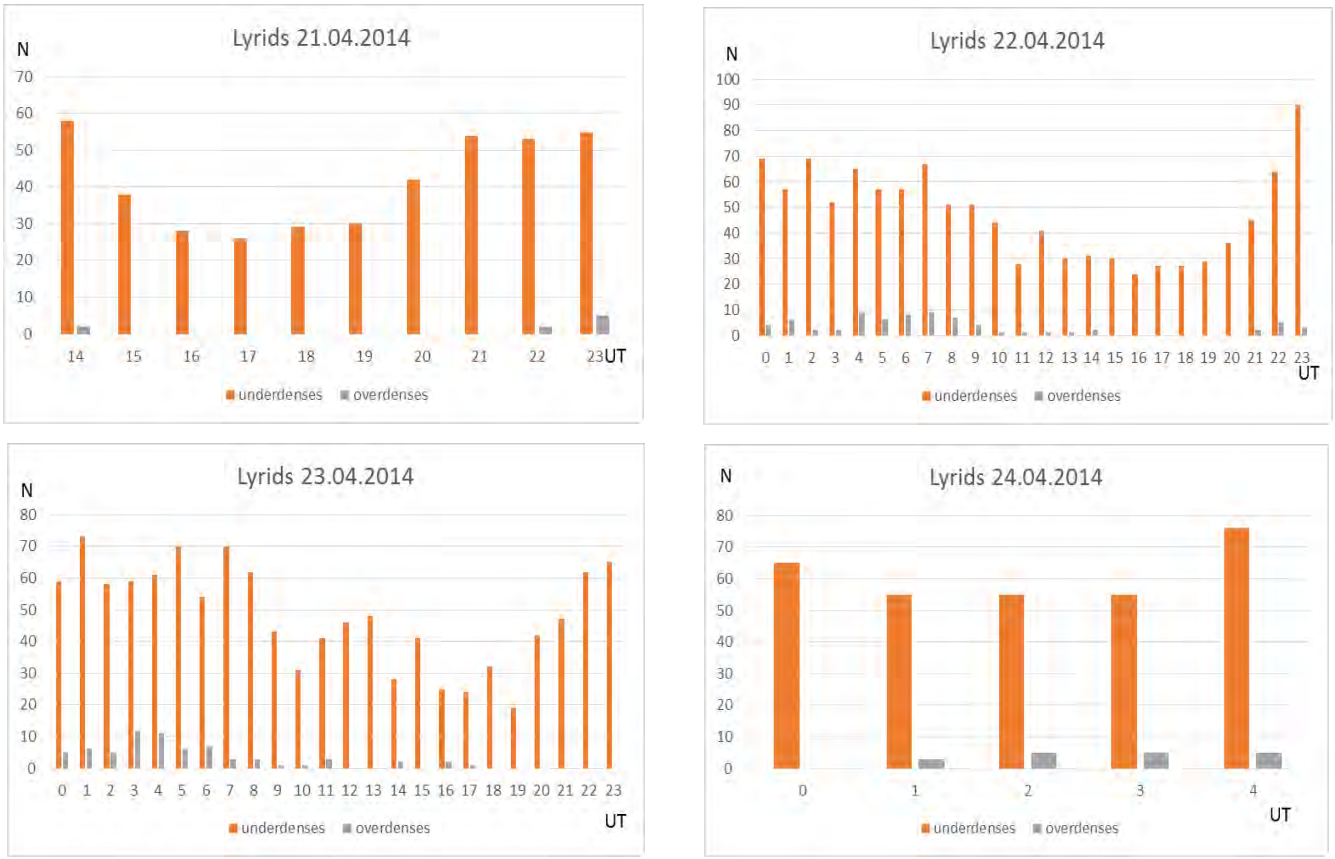


Figure 7 – EARS – Lyrids 2014 counting details (N number of echoes).

EARS Results

The EARS results are summarized in Figure 7. I rely on the visual counting of the meteor radio echoes on the JPG images produced by SpecLab V 2.76 b10, distinguishing underdense radio echoes and overdense radio echoes. on 23/04/2014 between 00^h00^m – 08^h00^m UT. The MARS counts, although not distinguishing between underdense and overdense radio echoes, are in agreement (Figure 6), although with different numbers of radio echoes compared to the EARS counts (Figure 7). EARS detections of spectacular overdense radio echoes like those in Figures 1 and 2 were not confirmed by MARS.

My EARS visual counts on the JPG images were surely contaminated by missing faint underdense and overdense radio echoes, and by missing meteor radio echoes hidden by the airplane radio echoes. But, apparently, the MARS automatic meteor counting program overlooked part of the underdense and overdense radio echoes. For example, as can be seen in Figure 3, one of the three underdense radio echoes on the left side was overlooked, and, as can be seen in Figure 4, one underdense radio echo on the left side was overlooked and two overdense radio echoes on the right were counted as seven radio echoes. The different counting methods adopted (visual counting on the JPG images for EARS, automatic counting for MARS), the contamination on the visual counting of EARS, the "behaviour" of the MARS automatic meteor counting program and the weaker meteor radio reflections received by MARS due to its longer distance from the Graves radar emitter, explain the EARS – MARS meteor radio echo counting differences.

3 Camelopardalids 2014

The Camelopardalids meteor shower was generated on 23-24/05/2014 by the passage of Earth through the path of the debris of comet 209P/Linear. EARS and MARS worked again in parallel on 23-25/04/2014 for a new combined observation campaign.

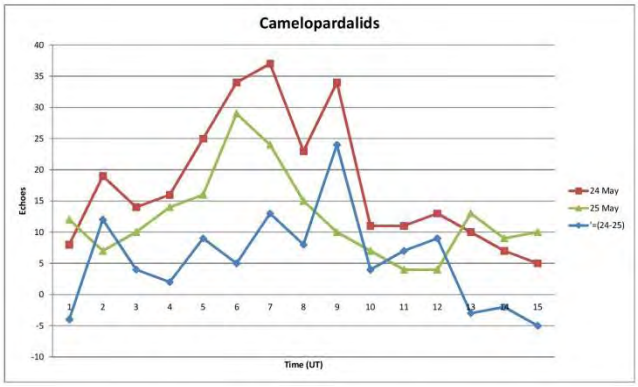


Figure 8 – MARS – Camelopardalids 2014 counting details.

MARS Results

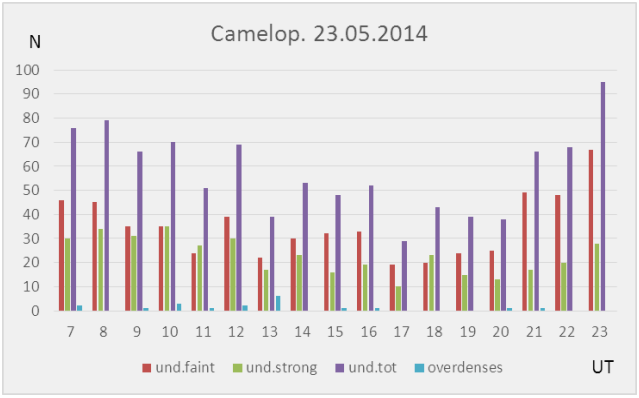
The results of the MARS radio observations of the Camelopardalids 2014 are summarised in Figure 8.

EARS Results

The results of the EARS radio observations of the Camelopardalids 2014, by distinguishing between strong and faint radio echoes on the basis of the adopted underdense reference meteor echo (Figure 1), are summarised in Figure 9.

Discussion

EARS (Figure 9) recorded a double maximum for the Camelopardalids 2014 superimposed on the background of the sporadic meteors. A first maximum (Figure 9, better indicated by the overdense radio echoes) on 23/05/2014 between 09^h00^m – 16^h00^m UT and a second maximum (Figure 9, better indicated by the overdense radio echoes) on 24/05/2014 between 00^h00^m – 09^h00^m. The MARS counts, although not distinguishing between underdense and overdense radio echoes, are in agreement (Figure 8), although with different numbers of radio echoes compared to the EARS counts (Figure 9).



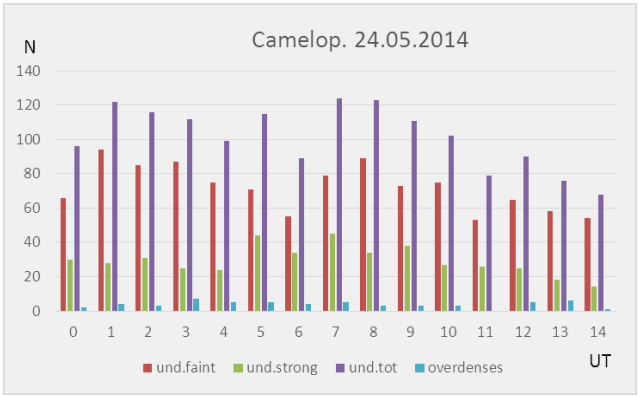


Figure 9 – EARS – Camelopardalids 2014 counting details

4 Conclusion

As expected, the radio observing results of EARS and MARS are in agreement to each other. However, further observations are necessary, as usual in science, to estimate the missing faint underdense and overdense radio echoes and the missing meteor radio echoes hidden by the airplane radio echoes in the EARS radio observations, and to estimate the underdense and overdense radio echoes missing because of the "behaviour" of the MARS automatic meteor counting program in the MARS radio observations.

Acknowledgement

I am grateful to Alexei Pace for having given me the permission of inserting the MARS results concerning the Lyrids and Camelopardalidis 2014 in the present article.

References

Tomezzoli G. T. (2014). "Progress on radio astronomy in Munich, Germany". In Gyssens M., Roggemans P., and Żołądek P., editors, *Proceedings of the International Meteor Conference*, Poznań, Poland, 22–25 August 2013, IMO, pages 78–80.