

The Music of Light Curves

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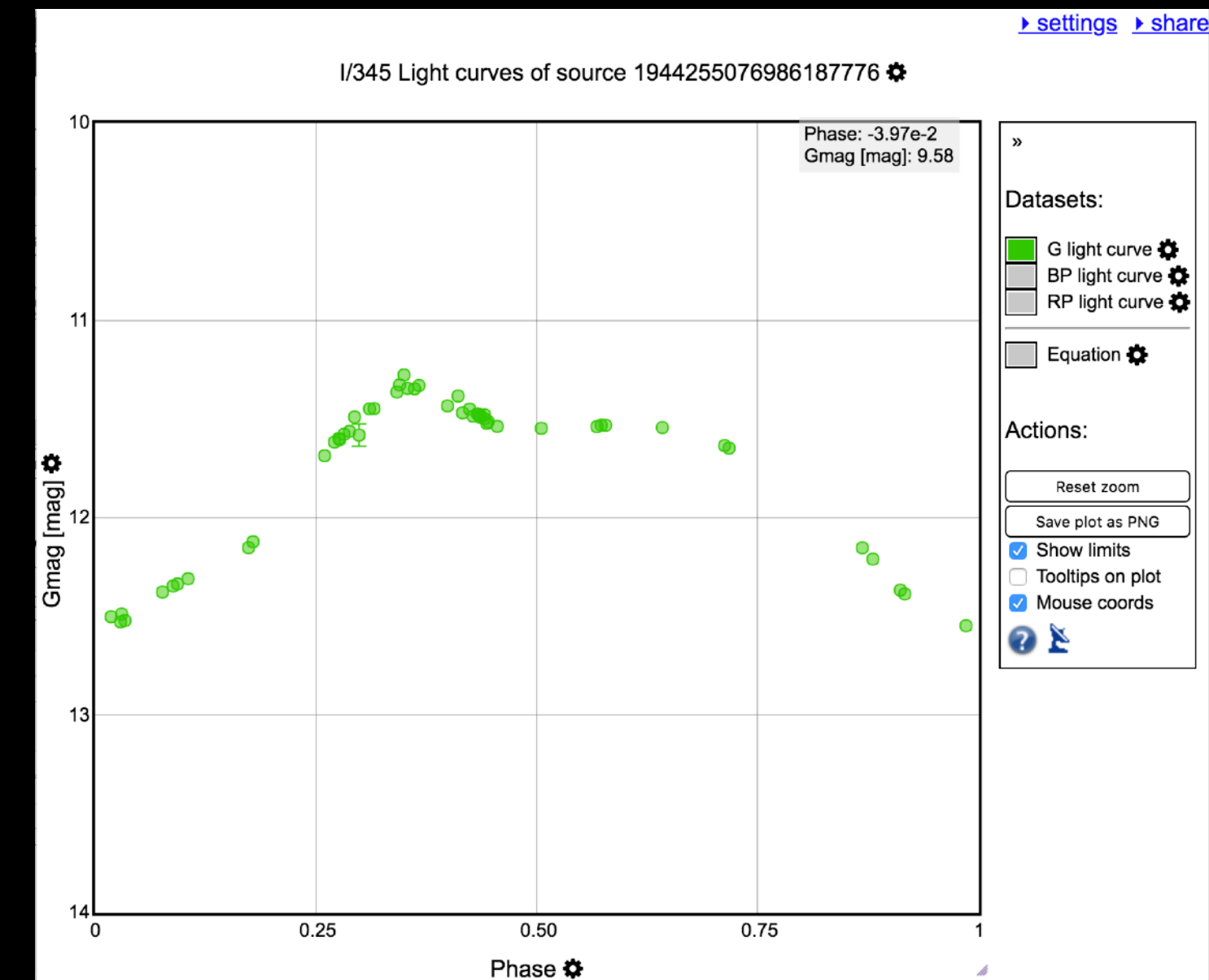


How It Works

- Light curves of variable stars are taken from VizieR data
- Light curves are graphically extrapolated with machine learning techniques
- Frequencies are sampled from the extrapolated data and converted to notes using Javascript
- The Aladin sky atlas is used to interactively play the songs of variable stars

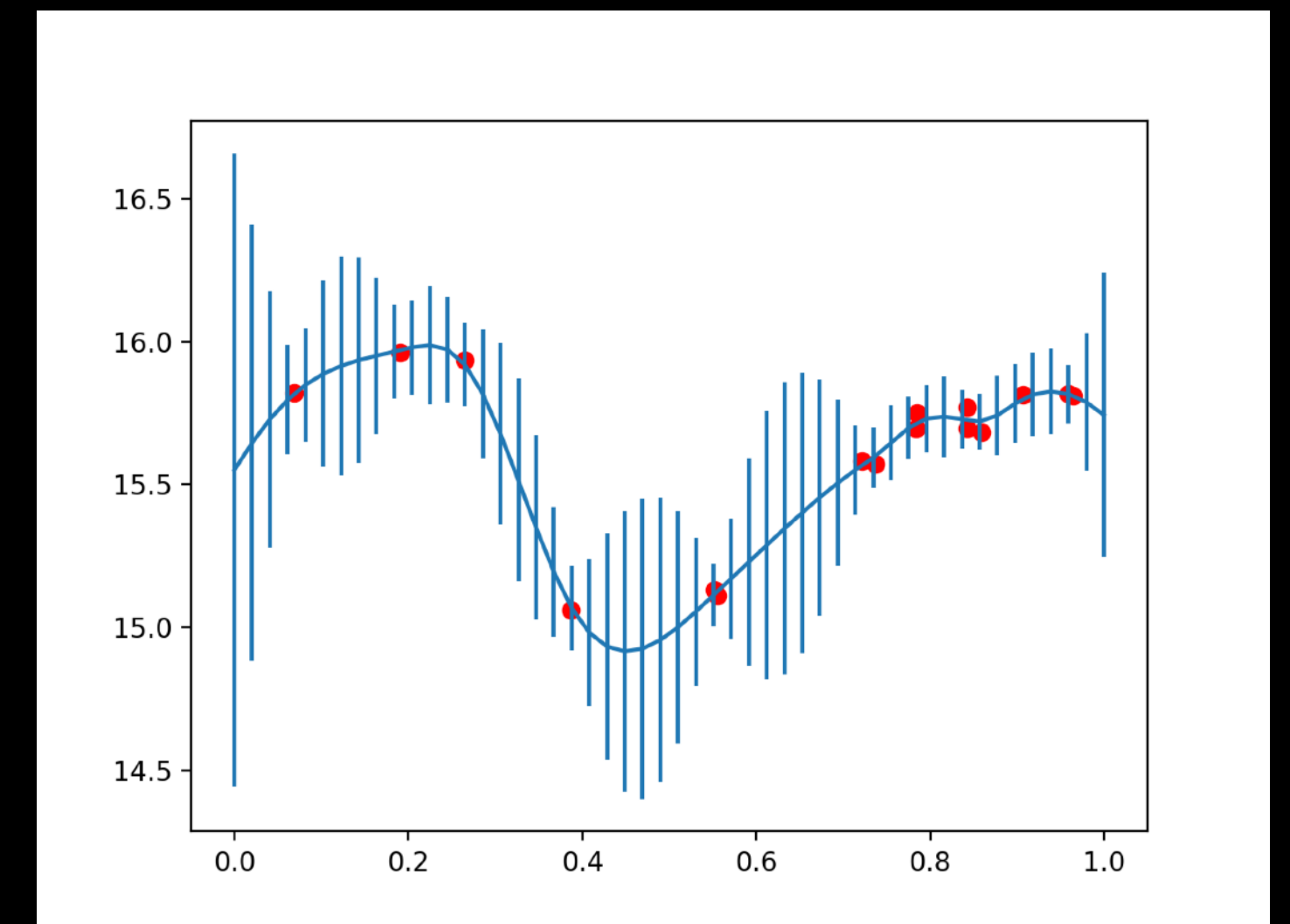
VizieR data

- Data was obtained from the VizieR database – specifically from the Gaia DR2 catalogue of variable star light curves
- Light curves were separated into separate wavelengths – we chose to use the G band, but any of the three could be played trivially



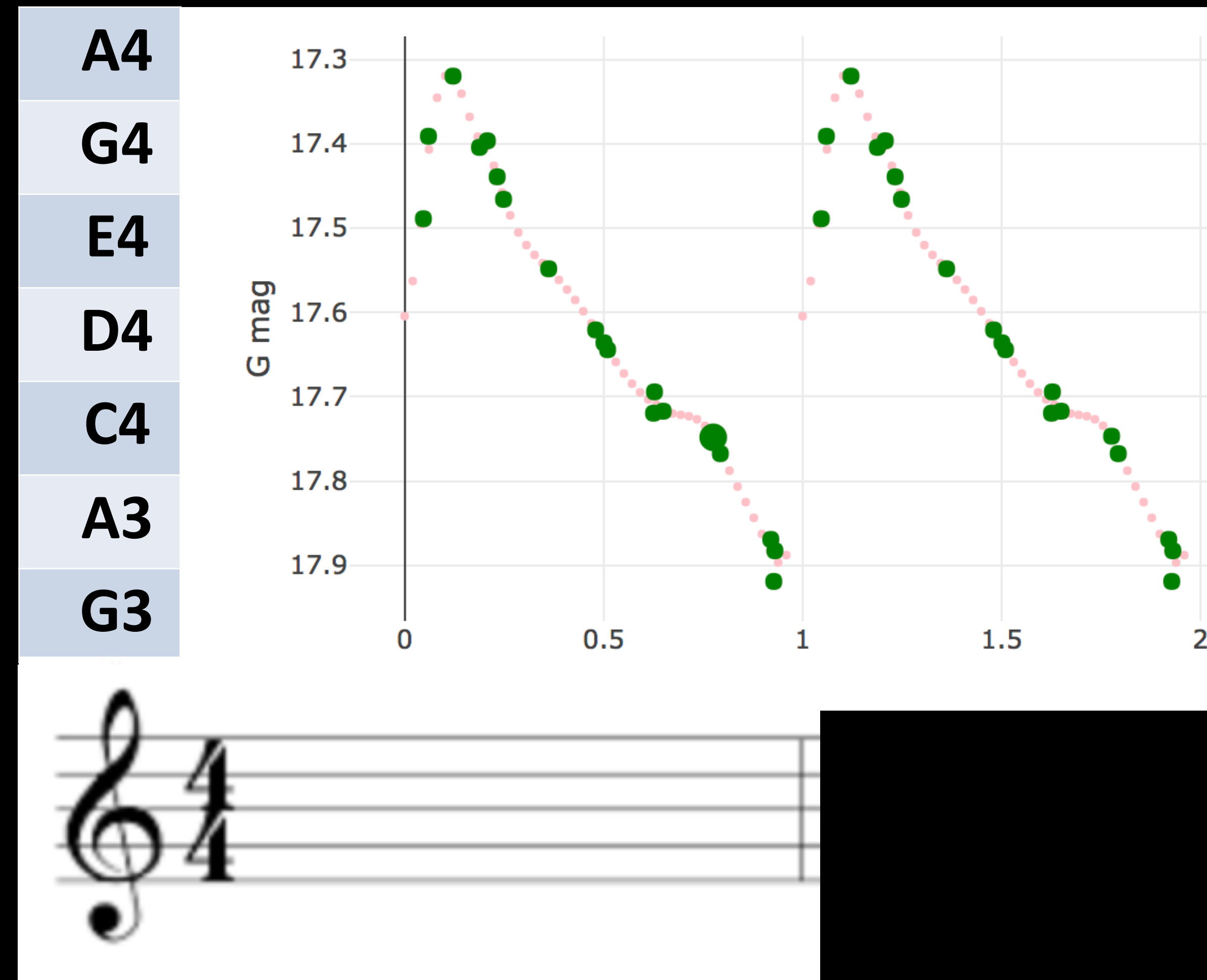
Data Extrapolation

- Getting good rhythm was hard with the variable times between data points in the light curve
- A Gaussian process was used to extrapolate the data and obtain a continuous function of light magnitude in the phase diagram for the 10k stars of the sample
- Python : *scikit-learn*



Melody Generation

- G magnitude values were sampled from the continuous functions at regular intervals
- Playing one period of light curve data points is normalized to last a measure
- *Tone.js* was used to synthesize sounds from magnitudes, in an appropriate key, with an appropriate synth sound



Scientific Uses

- Light curves can have certain “sound signatures” which can identify specific features
- Data accessibility/visualization

Thanks

- The hackathon organizers
- Kai Polsterer
(technical advice on gaussian processes)
- Sebastien Derriere
(for the initial idea: [arXiv:1811.02930](#))

Demo

- <https://tboch.github.io/music-lightcurves-hack/>
- Code on Github
<https://github.com/tboch/lightcurves-music>