Overview:

Mass photometry is a technique that uses interferometric scattering to measure the mass of particles. The basic principle is that the signal received by the detector is a combination of light scattered by the particle and the substrate it sits on. To infer the mass, one has to subtract out the background signal to isolate the signal of the particle itself. To get a more accurate estimation of the background, the authors use a sliding window approach to average more frames together. This is done because the SNR is low and this is a shot noise dominated process.

The basic idea behind the data analysis is shown below:

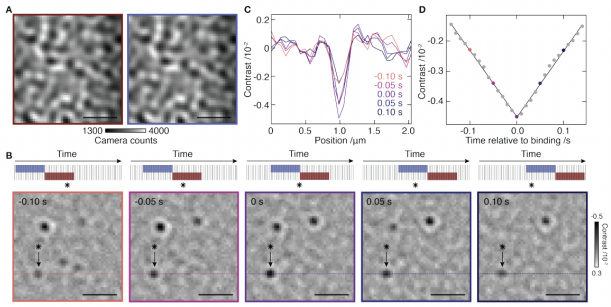

Fig. S3.

Data analysis. (**A**) Raw camera images before and after the landing event in **B-D** showing image contrast due to coverslip roughness. (**B**) Illustration of the image averaging and differential imaging approach. The asterisk marks a landing event. Individual images are averaged into two consecutive blocks (blue and red), which are normalized and divided to provide differential contrast. The mid-point is scanned in time, meaning that the signal from stochastic landing events grows and fades, as indicated by the black arrow. Scale bars: 1 µm. (**C**) Corresponding cross-sections for the particle highlighted in **B**. (**D**) Corresponding signal magnitudes extracted by a fit to the PSF and fit (black).

However, one may ask why not include more frames in the sliding window approach to increase the signal. Essentially, the noise of the signal is changing as a function of time, so you are limited to how many frames you can use in the averaging. In the original paper, the authors only used 7 frames. In other words, a static approach that assumes the noise/background is constant for that many frames.

The question I am going to tackle in the project is to use more sophisticated methods to get a more accurate estimate of the background. I will implement basic Poisson denoising techniques and will also explore other statistical methodologies in the context of dynamic background estimation. I am specifically thinking of using a technique known as changepoint detection to infer the stochastic nature of the noise.

I work in a lab where we have access to data from this technique, so I will implement both the naive background estimation in addition to the other methods I will explore.