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Iridescent Water Droplets Beyond Mie Scattering Supplemental

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1. Fitting

As we explain the main paper, we need to determine the levitation height and droplet size and input them into the first-order Quetelet scattering model. We make use of thermal and optical images to build an empirical model that relates water surface temperature and droplets' size and height. Specifically, we take out-of-focus images of the water surface (odd columns of Figure 2 and 3). In these images, we observe a bright white circle, which is the reflection of the light source. We also see colorful rings around the light source and horizontal colorful stripes. The color pattern in out-of-focus images is much more regular than that of in-focus captures as they essentially average out local randomness in droplet size and levitation height. We estimate the average radius and levitating height by comparing the captured images and renders. The renders are shown in the even columns in Figure 2 and 3. We build an empirical model using the temperature on the water surface captured using the infrared thermal camera. As a result, we can relate temperature and droplet radius, as well as temperature and levitating height directly:

$$\begin{aligned} r &= 0.1613T - 5.5078 \\ h &= 0.2679T - 8.2595, \end{aligned} \tag{1}$$

where r denotes radius in microns, h is the distance from water surface to the droplet center in microns and T is temperature in degree Celsius. These two function are plotted in Figure 1 from 55 to 90 degree Celsius. We compared our temperature-radius relation with [UONI15] (Figure 1 in their Corrigendum) and our results mostly align with their data, though the radius prediction is slightly smaller than the average radius reported in [UONI15]. [ZKKA21] report that the levitating height has a large increase for small radii but we did not observe that in our data. In future work, we would like to simulate the levitating height and droplet radius directly using a physically based model and compare with the empirical fit.

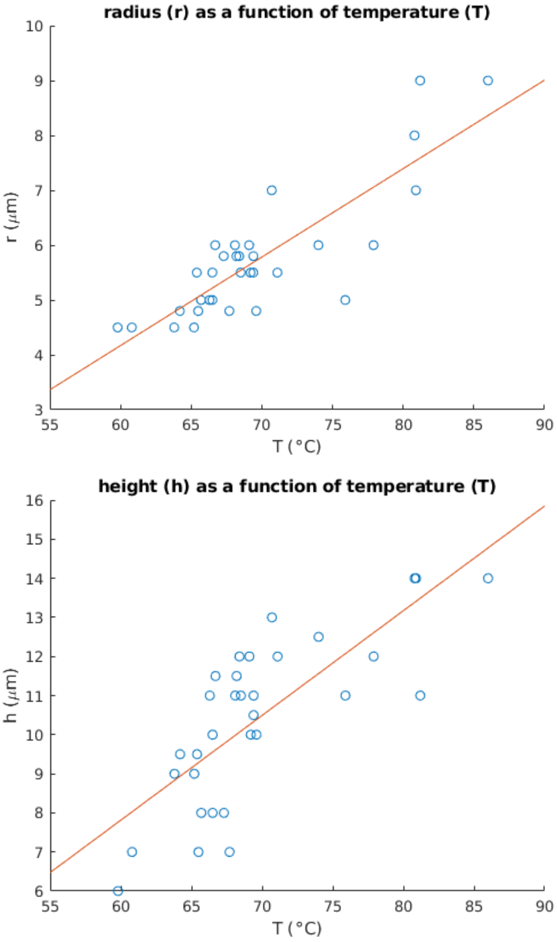

Figure 1: *We fit the relation between droplet radius and temperature, as well as levitating height and temperature.*

References

[UONI15] UMEKI, T., OHATA, M., NAKANISHI, H., and ICHIKAWA, M. "Dynamics of microdroplets over the surface of hot water". *Scientific reports* 5 (2015), 8046 1.

[ZKKA21] ZAITSEV, D. V., KIRICHENKO, D. P., KABOV, O. A., and AJAEV, V. S. "Levitation conditions for condensing droplets over heated liquid surfaces". *Soft Matter* 17.17 (2021), 4623–4631 1.

Figure 2: *We show the captured out-of-focus Quetelet patterns (odd columns) on water surface and the corresponding renderings (even columns). The fitting parameters are specified on the two sides.*

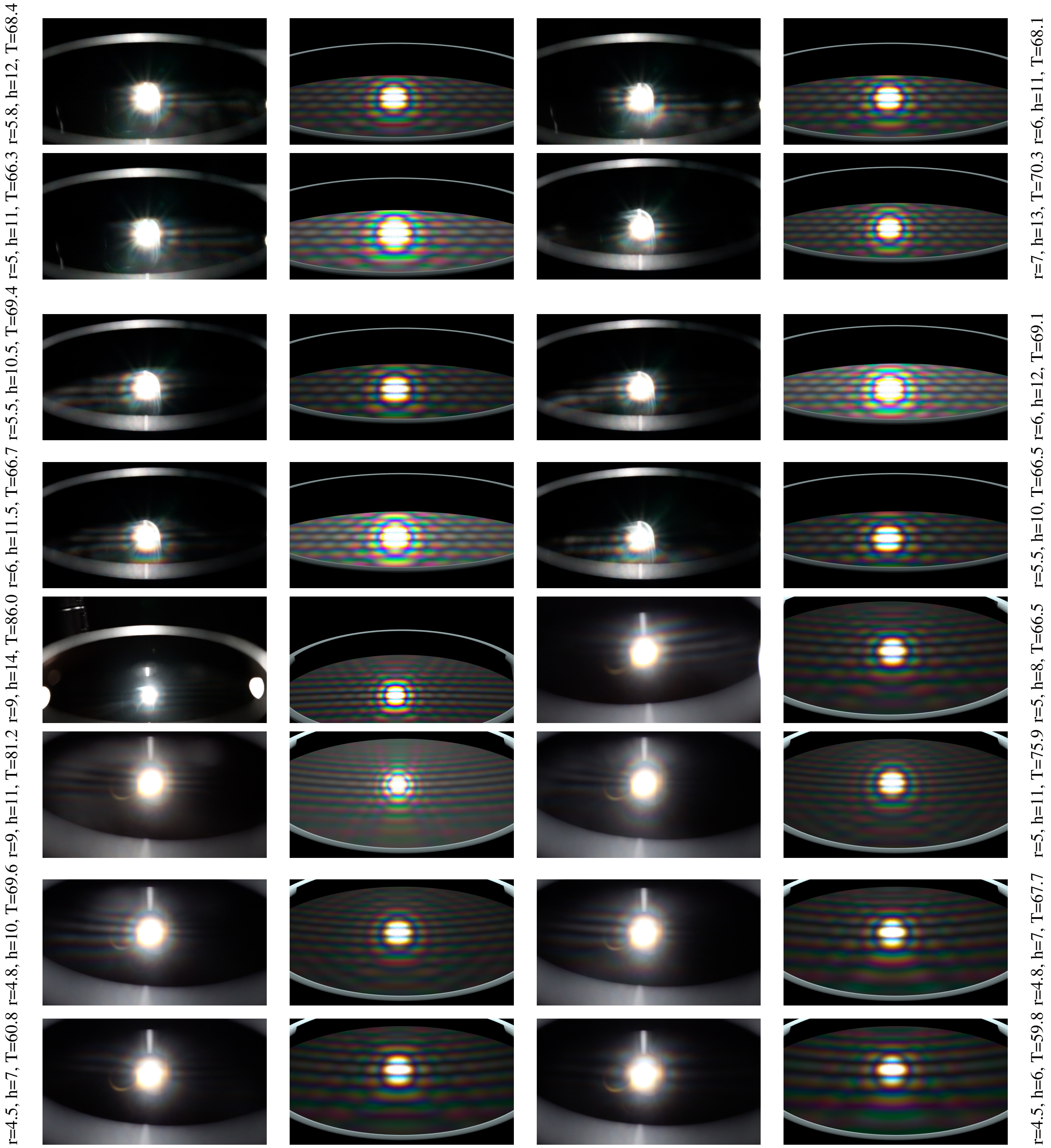

Figure 3: *We show the captured out-of-focus Quetelet patterns (odd columns) on water surface and the corresponding renderings (even columns). The fitting parameters are specified on the two sides.*