Group 3 Report

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5/4/2011

The objective of this image was to capture condensation from supersaturated air onto the ceiling of a steam room. When I initially started this project I had planned to take pictures of dry ice. I quickly noticed that in order to get good images of the dry ice I would have to find a room that has no turbulent air current. My apartment complex has a fully insulated steam room so I decided to work in there. My land lady found me and after I explained what I was doing offered to help me. As the land lady she had the ability to override the maximum temperature setting on the steam room. We were able to set the steam room temperature up to 180 deg F (I don't think it ever actually got that high but we were able to get some extremely super saturated air by doing so). We then had to pump the steam out of the stream room (using a system of fans) and were able to take pictures of the condensation that had formed on the walls.

The image shows a large collection of droplets which have condensed onto the surface of series of ceramic tiles. The tiles themselves are roughly 4in by 4in. The droplets seem to come in two distinct size groups. There are some droplets which when looked at appear abnormally large. These are the droplets that seem to have a gem like quality in the picture. These droplets very quickly started to drip off of the ceiling and onto the floor of the steam room since they had far too much weight for their adhesion to the ceiling. There is a collection of much smaller droplets which were able to stick to the ceiling for literally days after the event. These droplets are at most an eighth of an inch in diameter and can be seen intermittently between the large drops in the picture. Based on my research I suspect that the abnormally large drops are the result of extremely fast condensation on the ceiling of the steam room. When the steam enters the room at 180 deg F it is able to hold a very large amount of water (high absolute humidity). However upon rapid cooling the air looses the ability to hold anywhere near the much water and is forced to precipitate out enough water to form these ridiculously large droplets.

The largest problem that I had with the visualization technique was actually the effect of condensation on my camera. I had to start taking pictures almost immediately after we turned off the steam jets or else all of the abnormally large water droplets would have already dripped off of the ceiling. I had tried taking pictures from far away but these images failed to portray just how large the water droplets actually were. When I took the camera close the droplets however the remaining hot humid air in the room would immediately begin to condense on my camera. In the image that I submitted it looks as if I have a little bit of blur. It isn't actually blur but rather the beginning of a sheaf of condensation on the lens of my camera. I was only able to get about 2-3 trys to get it right before my landlady decided that I needed to stop pumping hot steamy air into the apartment complex hallway so I had to accept the image that had the least blur. If I had had a larger fan or perhaps the ability to pump more humid air out of the steam room faster I might have been able to eliminate this blur effect all together.

In this image I used a 1/8 second exposure time. I would have liked to use more but the fact that I quickly had to determine the exact location to take a picture by hand (no tripod available) prevented me from being able to use a longer exposure time without introducing motion blur. I used a standard 55mm focal length and had a 5.6 f-stop. In this image I used a particularly low ISO (only 400) despite the fact that the lighting in the room was particularly low. I had tried using both better lighting and a flash in other images and they seemed to detract from the image a significant amount. I would have liked to show some of the images that contained a flash as they did seem to allows for a slightly sharper focus on the water droplets.

The field of view of this image shows about four complete 4 inch by 4 inch tiles. The image was taken from about 1 foot away with roughly a 45 deg angle. The camera used was a Canon PowerShot SX130 IS. I put the image through a fair amount of processing in gimp. I increased the reds and tried to take it away from looking like it was artificially lit. I tried to use the sharpen tool in some place and although it helped the small amount of blur from the condensation on the lens didn't react well to the sharpening tool. I darkened up the image somewhat and really bumped up the contrast.

I was very happy with the image. I was also very happy for the opportunity to work on this project with someone who wasn't in the class. I honestly thought that spending time with my land lord and explaining the physics of what we were seeing to a lay person was one of the best things I've done in the this class all semester. I think that the image does a good job of showing the impact of cooling a supersaturated fluid even if I have no mathematics to show for it. (I couldn't think of any dimensionless value that would be meaningful for this image). I would have liked to get rid of the condensation blur on my lens. It wouldn't have been particularly large and if this image was is a very sharp relief I think it would be much more impressive. I would simply need permission from my land lady again and a large enough fan.