A Novel, Patent-Pending Light Microscope Technology that Achieves World-Record Resolving Power: The Moleculescope by Yancy Corporation

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Yancy, Corp. has developed the Moleculescope, a novel, patent-pending light microscope technology that achieves world-record resolving power. The Moleculescope is a wide-field true-real-time reflected-visible-light microscope which, unlike existing light microscope technology, is not diffraction-limited. This paper presents images with resolved features smaller than 30nm illuminated with a 488nm light source--a 67% improvement over the best known technique. The underlying mechanic is well understood and protected by a comprehensive set of claims in US Patent App. 20140240823 (international patents also pending). Yancy, Corp. intends to establish a subsidiary corporation from which to license the intellectual property.

Introduction to the Moleculescope

The Moleculescope (hereafter System) is a non-destructive, wide-field, true-real-time reflected light microscope with a resolving power proven to be 30nm or smaller, a 67% improvement over the existing world record. Unlike competing techniques, the System does not require sample preparation, destruction, or post-processing of data, which encourages broad adoption across industrial and academic sectors. The System is not diffraction limited; the theoretical limit of the underlying technology is believed to be smaller than 1Å.

The System imaged a 2000 line/mm calibration grating standard (Pelco® 677-STM). Figure 1 displays an AFM image of the sample, and

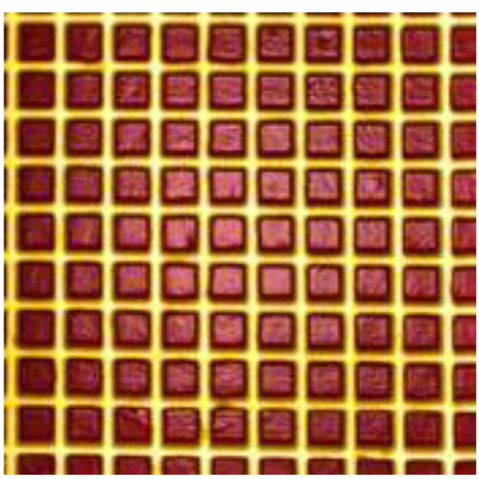

Figure 1. AFM Image of the 500nm-pitch Pelco 677-STM Calibration Standard (courtesy of Ted Pella)

Figure 2 displays images from the System at two magnification levels. The sample was illuminated by a 488nm laser. No sample preparation was required, and a real-time video transmission of the sample was observed. The

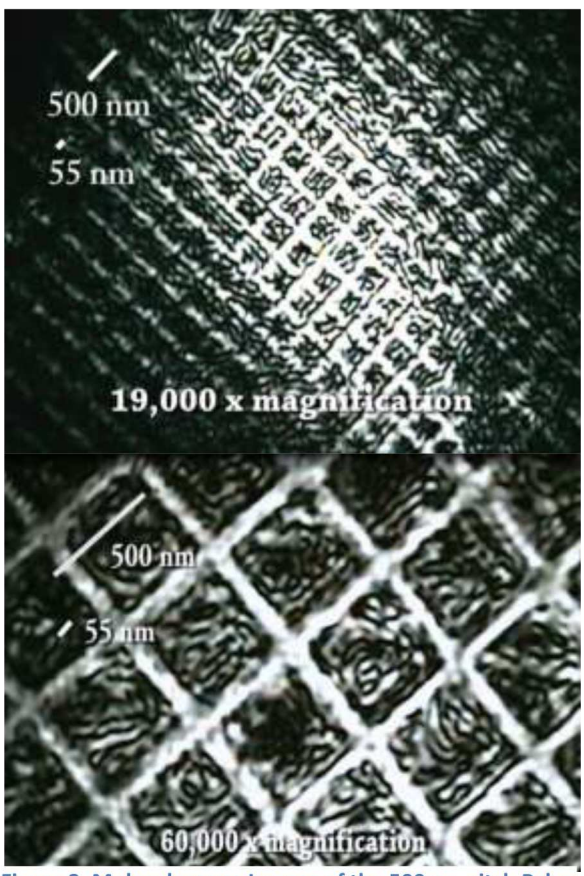

Figure 2. Moleculescope Images of the 500nm-pitch Pelco 677-STM Calibration Standard, Indicating Resolving Power of approximately 30nm.

orderly grid pattern at 500nm pitch is clearly resolved, as are the individual 55nm grid lines, as is the <30nm disorderly interstitial texture. The combination of highly-ordered grid lines and a disorderly texture in the valleys reinforces the accuracy of the resolved features.

State-of-the-Art

Figure 3 is an image collected by researchers in 2011 that demonstrates a technique capable of resolving features as small as 50nm. To achieve this, the research team fabricated microscopic glass spheres and affixed them to the sample, creating a far-field super lens to capture evanescent waves not subject to the diffraction limit[i]. This technique still[ii] represents the highest documented wide-field visible-light resolution microscope and was the subject of wide-spread popular and academic media attention at the time. The Figure 2 images were collected on a "garage" prototype (estimated cost of goods $5000), yet still prove an improvement over the current state of the art.

The Moleculescope's Revolutionary Capability

The System represents a revolutionary improvement to the state-of-the-art in both performance and usability. Where existing visible-light wide-field super-resolution techniques are small improvements to stretch the Abbe limit of

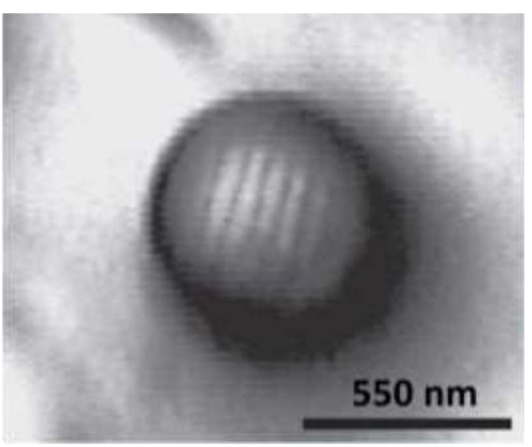

Figure 3. Glass-Sphere Microscopy Technique Demonstrating 50nm Resolution (lines shown have 100nm pitch). This is the current state of the art for real-time wide-field visible-light microscopy.

$$d = \frac{\lambda}{2n \sin\theta}, or \sim 200nm,$$

the System design is not subject to Abbe at all, instead only being limited by the quality of its optical components. Where existing visible-light wide-field super-resolution techniques are difficult, costly, and/or destructive (which has limited adoption to researchers operating within strict protocols), the System design may be widely adopted by the metrology industry. Viruses (20-300nm) and cutting edge semiconductor processing (14nm) may be directly observed or inspected in real time, which has not been possible with any technique prior to the Moleculescope.

Intellectual Property Protection

The System utilizes a novel imaging technique previously unseen in academic literature or patent publications. Yancy, Corp. has filed for patent protection in the United States (20140240823) and internationally for the Moleculescope method and apparatus. The founders have explored the invention and its ramifications for more than 10 years in an effort to establish a comprehensive set of claims. In September 2014, an International Search Report (conducted by the European Patent Office under the Patent Cooperation Treaty) affirmed that the patent claims are novel.

Intentions for Commercialization

Yancy, Corp. (incorporated in Corvallis, OR and operating in Phoenix, AZ) intends to spin off a wholly-owned subsidiary from which to license this technology. A Series A round is required to fund operations for this subsidiary (Yancy will remain tightly held). As of September 2014, no detailed plans have been established regarding fundraising or operating.

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[i] Wang, Zengbo, et al. "Optical virtual imaging at 50 nm lateral resolution with a white-light nanoscope." Nature communications 2 (2011): 218.

[ii] Hao, Xiang, et al. "From microscopy to nanoscopy via visible light." Light: Science & Applications 2.10 (2013): e108.