Lowell Milken Center for Unsung Heroes
ARTEFFECT

Impact Statement

Fangyi Niu, Grade 9
The Endless Pursuit of Knowledge, 2025
Colored pencil, marker on paper, 11 x 14 inches
Leland High School, San Jose, CA
Teacher: Yunhua Fang, Independent Study
Unsung Hero: al-Battani (approved by request)

My kindergarten teacher introduced astronomy to me when I was only five. I remember that day very clearly. He pulled out a book on astronomical objects and had one student pick a section to read every class. This made me exceptionally intrigued when I learned that such beautiful things like nebulae or galaxies could exist in a world that seemed so small to me at the time, a small event which hooked me on what is now one of my greatest interests. It is one of the only things that I can still remember from that period of my childhood, and it is also one of the only hobbies that have followed me throughout my entire life, which is the reason why I chose al-Battani– because I believe that his contributions and impact on many of my favorite astronomers should be celebrated as much as any other mathematician– all of which helped make astronomy so accessible today.

al-Battani was an Arabic astronomer and mathematician from 858 A.D. who was a pioneer in trigonometry, also compiling many calculations and tables. He refined Ptolemy's astronomical calculations (from Ptolemy's book Almagest, focused around the apparent motions of stars and planets. By replacing geometrical methods with trigonometry, al-Battani gave a much more accurate description of the Sun and Moon's motions). He was one of the first to use algebraic methods over geometric ones, which was a significant advancement in his time because it allowed for much more abstract and powerful ways to manipulate mathematics, leading to considerable progress. One of his most important contributions to the world of math was replacing antiquated Greek chords with sines, cosines, and tangents, all of which are still used today. Hipparchus, who is considered to be the father of trigonometry, invented a trigonometrical system based on chords (length of a line segment connecting two points on a circle) in a unit circle, which anyone who has taken Algebra 2, Precalculus, or Calculus should be familiar with. Changing these to modern signs provided a much easier and more convenient way to use angles and triangles.

Aside from this, al-Battani also catalogued 489 stars. He calculated the value of a year– off by only an astonishing two minutes. He showed that the apogee (the distance from Earth to the sun) varies, setting the stage for Johannes Kepler whose first law states that planets move in ellipses (an incredibly momentous discovery, crucial to the heliocentric theory). He also influenced the work of astronomers such as Tycho Brahe,

Nicholaus Copernicus, and Galileo. Lastly, al-Battani calculated the inclination/obliquity of the ecliptic (Earth's axial tilt to the plane of the celestial equator) to be 23 degrees and 35 minutes (about 23.58 degrees, only 14 degrees more than the true value). He was also very interested in astrology, which is not science but was also touched upon in his work.

I was conflicted at first whether to draw a figure from such a long time ago, mostly due to the lack of visual examples of his work or even a realistic depiction of him. All I had to work with was a single sketch of him and his astrolabe. I decided to be more interpretive and create a new, original image of him through extensive research about him, his work, and the resources available during his time. Although I may not be able to convey all of al-Battani's achievements through my piece, I certainly hope to be as close as possible. My artwork features three depictions of my unsung hero– with the focus being drawn to the one sitting on a triangle with an angle denoted as theta, referring to his contribution of replacing chords with trigonometric functions. He sits with an enlarged astrolabe, which was a common tool used to determine time, movement of celestial bodies, and sometimes for astrological purposes. The astrolabe is also the only object that the single depiction of him online was carrying, and due to the nature of the work he had done, I think it is important to his character. The item on the very left was taken from the Latin translation of Kitāb az-Zīj aṣ-Ṣābi' (Book of Astronomical Tables), a book he wrote in around 900, and I believe it to be one of the astronomical tables that the book contained. In the background are the Western zodiacs, Cancer and Capricorn, an allusion to his studies of astrology. The clothing and objects are all accurate to the period and region he is from. I attempted to depict the scene in dramatic, varied lighting to give it an otherworldly and poignant feeling, placing the objects in space to create an intense and impactful contrast with the sun in the top right. Both Venus and Earth are depicted in orbit, mirroring al-Battani's improvements on calculations surrounding planetary orbits and motion.

I hope that this piece can inspire the awe and reverence for science and math that I attempted to convey. My love for both the technical and theoretical aspects of astronomy was what pushed me to spend so much time on this drawing. It has always been my dream to propagate knowledge and skills through any way that I can, and I view this creation as a step forward in my journey. This year, I have begun seriously making progress into learning astronomy and astrophysics, including volunteering to teach children at libraries, participating in events at the San Jose Astronomical Association, self-teaching calculus, physics, general astronomy, cosmology, and more. I believe that I will be well-equipped for whatever comes next by junior or senior year. If possible, I will donate my artwork to the SJAA or the astronomy club at my school. This piece serves to reflect my passion and journey for the field from when I was a child and should also serve to motivate others to have more respect for those who have carried us to where science is today.