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Ibn ʿIrāq: Abū Naṣr Manṣūr ibn ʿAlī ibn ʿIrāq

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Born **Gīlān (Iran)**, ***circa* 950**

Died **Ghazna (Afghanistan)**, ***circa* 1036**

Ibn ʿIrāq was an astronomer who also made important contributions to trigonometry. His name and contemporary references to him as "prince" (*al-amīr*) suggest that he was a member of the Banū ʿIrāq dynasty, which ruled Khwārizm until the Maʾmūnī dynasty conquered it in 995.

Ibn ʿIrāq was a pupil of the famous scientist **Abū al-Wafāʾ al-Būzjānī**, and he, in turn, had a pupil who became one of medieval Islam's most famous scientists, **Abū al-Rayḥān al-Bīrūnī**. Among Abū Naṣr's works are a number of treatises answering questions posed by Bīrūnī.

At some point in the early 11th century – 1016 has been suggested – both Ibn ʿIrāq and Bīrūnī joined the court of Maḥmūd of Ghazna, Afghanistan, where Ibn ʿIrāq passed the rest of his life.

Ibn ʿIrāq was a capable astronomer, and Bīrūnī praised his method for finding the solar apogee as one that was as far beyond the methods of the modern astronomers as theirs were beyond those of the ancients. However, his chief astronomical work, the *Royal Almagest* (*al-Majisṭī al-shāhī*), is lost, with only fragments surviving. The same is true of his *Book of Azimuths*, on methods for finding the direction of Mecca (the *qibla*). Of Ibn ʿIrāq's surviving astronomical writings, a number of them deal with astrolabes, while others correct errors or comment on astronomical writings of such predecessors as **Ḥabash al-Ḥāsib** and **Abū Jaʿfar al-Khāzin**.

In another fragment of a lost writing, Abū Naṣr takes issue with a colleague who suggested that the planetary orbits might be ellipses, rather than circles, with a very slight difference between their major and minor axes. He also discusses the possibility that the motions of the planets in their orbits might be, not only apparently but in reality, nonuniform. Abū Naṣr comes down firmly for the prevailing ancient and medieval view, however, that all heavenly bodies move with uniform motion on circles.

Among Ibn ʿIrāq's most famous contributions to mathematical astronomy are his discoveries of both the Law of Sines (for plane and spherical triangles) and the polar triangle (of a spherical triangle). Indeed, it appears he got into a controversy with his teacher, Abū al-Wafāʾ, over priority in the discovery of the former. (It is quite possible, of course, that each discovered it independently of the other since many important mathematical discoveries have been made simultaneously by more than one person.) In any case, it is certain that Abū Naṣr brought the Sine Law into the mathematical limelight with his repeated use of the theorem and the several proofs he gave of it.

This interest in spherical trigonometry is very much in line with Abū Naṣr's preparing a reliable Arabic edition of the *Spherica* of **Menelaus**, the first treatise to focus on the importance of the spherical triangle.

It is interesting that the title of one of Ibn ʿIrāq's treatises (*On the reason for the followers of the Sindhind halving the equation*) shows that even in the late 10th or early 11th century astronomers of the caliber of Abū Naṣr were discussing seriously the contents of the then very ancient material of the Indian tradition in the *Sindhind*.

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