

# Guido Fubini

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**Born: 19 Jan 1879 in Venice, Italy**

**Died: 6 June 1943 in New York, USA**

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**Guido Fubini's** father Lazzaro Fubini was a mathematics teacher at the Scuola Macchinisti in Venice so he came from a mathematical background and was influenced by his father towards mathematics when he was young. Guido attended secondary school in Venice where he showed that he was brilliant at mathematics and it was clear from this stage that he would follow career in the subject.

In 1896 Fubini entered the Scuola Normale Superiore di Pisa. There he was taught by Dini and Bianchi who quickly influenced Fubini to undertake research in geometry. He presented his doctoral thesis *Clifford's parallelism in elliptic spaces* in 1900. Most young doctoral students take a few years to make themselves well known in their area. However, Fubini was lucky for his teacher Bianchi was about to publish an important work on differential geometry and he discussed the results of Fubini's thesis in his treatise which appeared in 1902.

Fubini remained at Pisa to qualify as a university teacher. Most mathematicians at this stage in their careers extend the work they have begun in their doctoral thesis. Not so Fubini. He attacked a completely new topic to the one he had studied for his doctoral thesis studying the theory of harmonic functions in spaces of constant curvature.

In October 1901 Fubini began teaching at the University of Catania in Sicily. There he won a competition to become a professor but soon he was heading north again when he was appointed to a chair at the University of Genoa. In 1908 Fubini moved to Turin where he taught both at the Politecnico and at the University of Turin.

Fubini's interests were exceptionally wide moving from his early work on differential geometry towards analysis. In this area he worked on differential equations, analytic functions and functions of several complex variables. He taught courses on these analysis topics at both the Politecnico and the University in Turin. During World War I Fubini studied the accuracy of artillery fire and these investigations led him on to work on acoustics and electricity.

He was nearing the end of his career when the political situation in Italy suddenly put him in an exceptionally difficult position. All had seemed well and, despite the problems suffered by Jewish people in Germany from 1933, it seemed as though Italy would not follow that route. Up to 1934 Mussolini regarded Fascism as a development within Western civilisation and distrusted Germany and especially Hitler's National Socialism, which he declared to be:-

*... one hundred percent racism: Against everything and everyone: Yesterday against Christian civilisation, today against Latin civilisation, tomorrow, who knows, against the civilisation of the whole world.*

However Mussolini soon found that he had to take the same line as the Nazis. In July 1938 he published the Manifesto of Fascist Racism and shortly after this anti-semitism became part of the official Fascist policy of Italy. A series of decrees removed Jews from positions of influence in government, banking and education. Fubini was forced to retire from his chair in Turin.

Certainly Fubini had no wish to leave Italy but he had two sons who were engineers and, always a man who was devoted to his family, Fubini decided that his sons had no future in a country whose official policy was anti-semitism. When he received an invitation from the Institute for Advanced Study in Princeton in 1939 Fubini made the decision which he believed was best for his family. They emigrated to the United States immediately,

although Fubini himself was in rather poor health by this time. Still, despite his health problem, he was able to teach for a few years in New York but, 5 years after emigrating he died of heart problems.

As remarked above, Fubini's interests in mathematics were wide. In addition to the areas of analysis detailed above, he worked on the calculus of variations where he studied reducing Weierstrass's integral to a Lebesgue integral and also he worked on the expression of surface integrals in terms of two simple integrations. Another analysis topic he studied was non-linear integral equations.

Fubini also worked on the theory of groups. In particular he studied linear groups and groups of automorphic functions. His interests included continuous groups where he looked at the question of putting a metric on the group. In non-euclidean spaces he extended results due to Appell and Mittag-Leffler. His most important work was on differential projective geometry where he used the absolute differential calculus.

P Speziali, writing in [1], sums up Fubini's achievements as follows:-

*Fubini was one of Italy's most fecund and eclectic mathematicians. His contributions opened new paths for research in several areas of analysis, geometry, and mathematical physics. Guided by an ever-alert geometric intuition and possessed of an absolute mastery of all the techniques of calculation, he was able to follow leads that had barely been glimpsed. His technical mastery often permitted him to discover simpler demonstrations of such theorems as those of Bernstein and Pringsheim on the development of Taylor series.*

Since Fubini's sons trained as engineers he took an interest in the problems they were studying. This led him to solve a whole series of engineering problems which he was writing up as a textbook towards the end of his life. The textbook, jointly authored with G Albenge, only appeared in 1954, eleven years after Fubini's death. This last textbook was one of an impressive collection of important textbooks on analysis which included books which described analysis courses which he had given and also books which were collections of problems.

Speziali [1] describes Fubini in these terms:-

*A man of great cultivation, fundamentally honourable and kind, Fubini possessed unequalled pedagogic talents. His witty banter and social charm made him delightful company; he was small in stature and his voice was vigorous and pleasant.*

He is rated highly for his wide ranging work and merits the high praise given in [1] where he is said to be:-

*... one of the most luminous and original minds in mathematics during the first half of the twentieth century.*

**Article by: J J O'Connor and E F Robertson**

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