

Classification of Rainbows

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Rainbows are the most beautiful and most spectacular optical atmospheric phenomenon. Humphreys (1964) pointedly noted that “the “explanations” generally given of the rainbow [in textbooks] may well be said to explain beautifully that which does not occur, and to leave unexplained which does” . . . “The records of close observations of rainbows soon show that not even the colors are always the same”.

Textbooks stress that the main factor affecting the aspect of the rainbow is the radius of the water droplets. In his well-known textbook entitled “the nature of light & colour in the open air”, Minnaert (1954) gives the chief features of the rainbow depending on the diameter of the drops producing it.

For this study, we have gathered hundreds of pictures of primary bows. We sort out the pictures into classes. The classes are defined in a such way that rainbows belonging to the same class look similar. Our results are surprising and do not confirm Minnaert’s classification. In practice, the size of the water droplets is only a minor factor controlling the overall aspect of the rainbow. The main factor appears to be the height of the sun above the horizon. At sunset, the width of the red band increases, while the width of the other bands of colours decreases. The orange, the violet, the blue and the green bands disappear completely in this order. At the end, the primary bow is mainly red and slightly yellow.

Picture = taken from the CNRM in Toulouse after a summer storm (Jean Ricard)