

'Can one hear the shape of a drum ?'



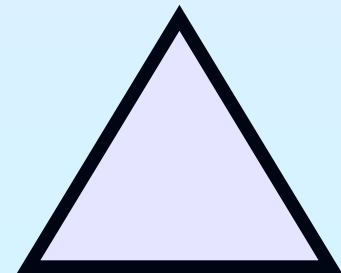
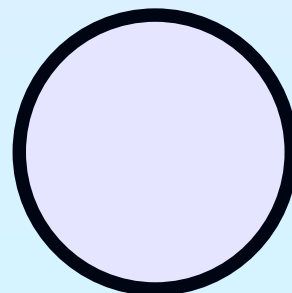
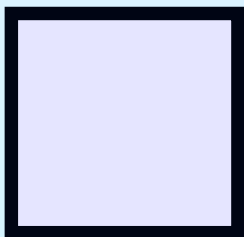
Marc Kac (1914-1984)

'האם ניתן לשמוע את צורתו של תוף?'

■ מרק כץ שאל שאלה זו ב 1966.



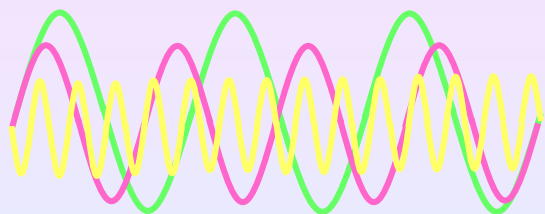
■ עבור מתמטיקאים ופיסיקאים צורתו של תוף אינה בהכרח עגולה.



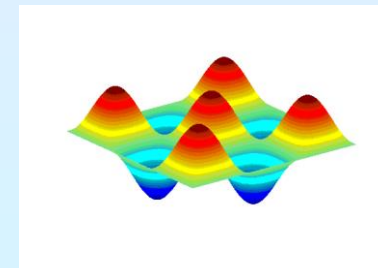
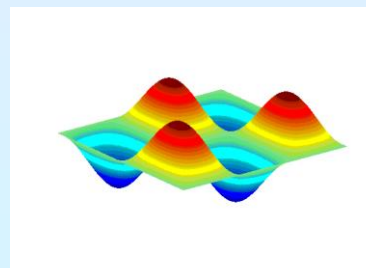
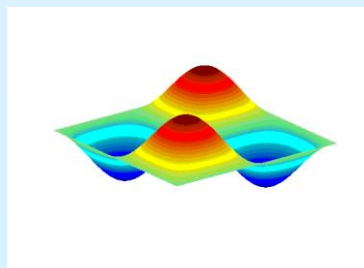
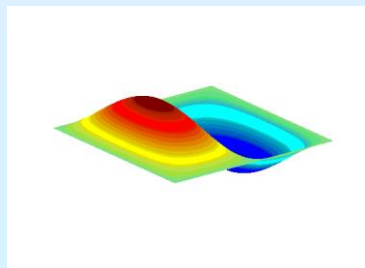


הספקטרום של תוף

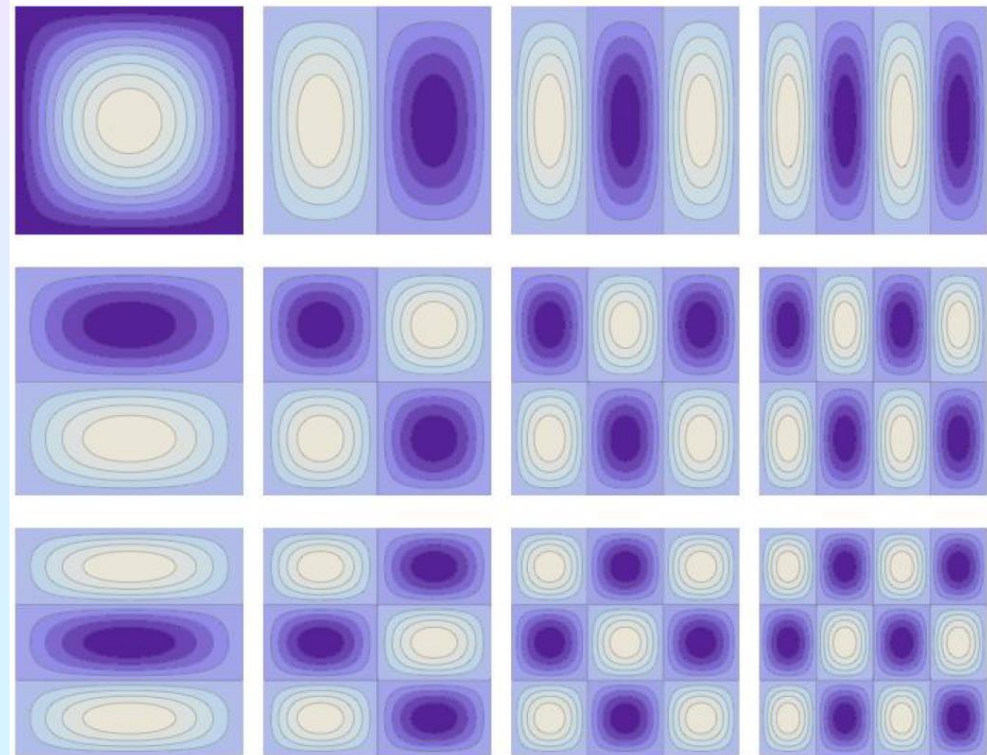
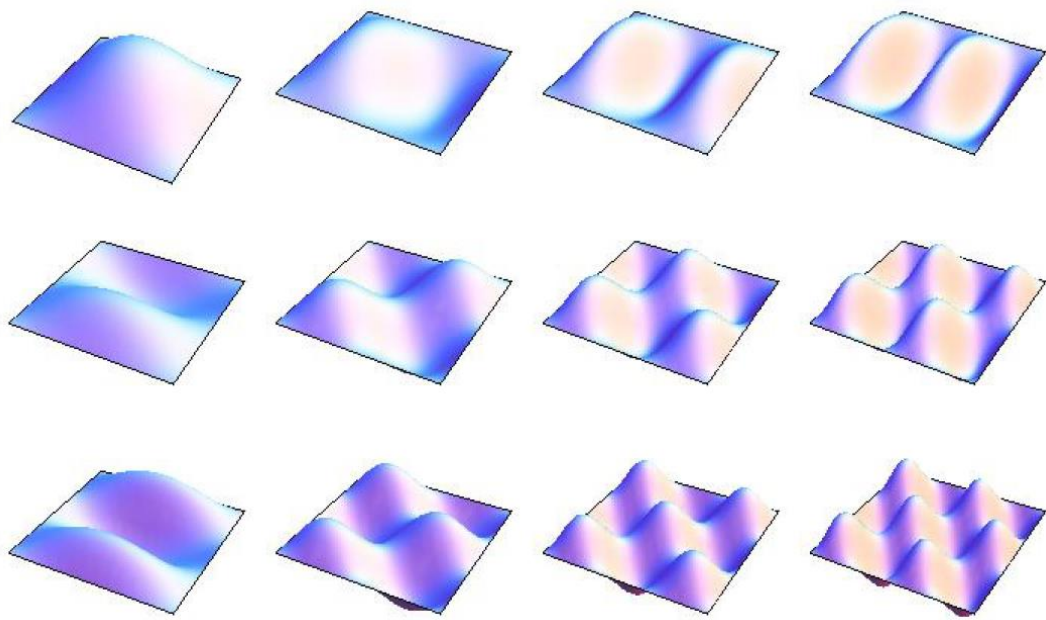
■ **תוף** הוא קרום גמיש המחובר בהיקפו למסגרת קשיחה.



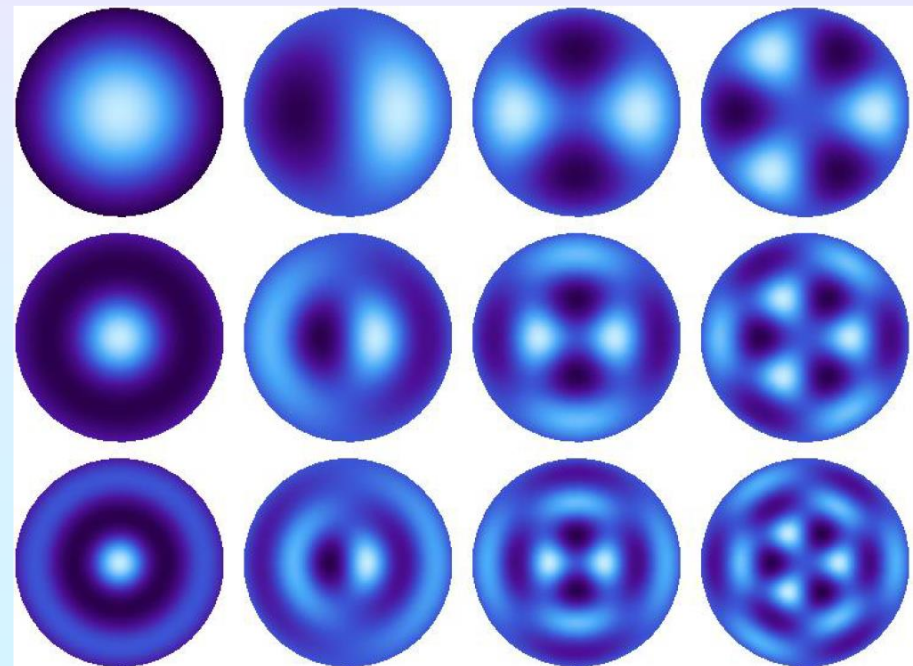
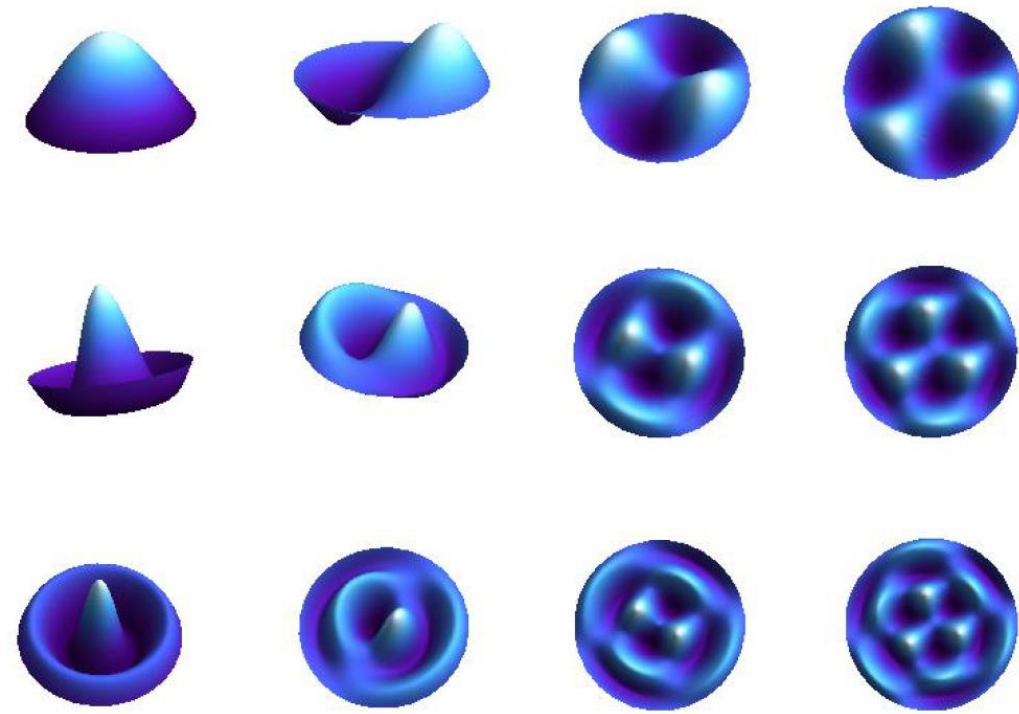
■ **ספקטרום** התוף הוא אוסף ה**תדירויות** הבסיסיות בהן קרום התוף יכול להתנוודד.



הספקטרום של תוף ריבועי



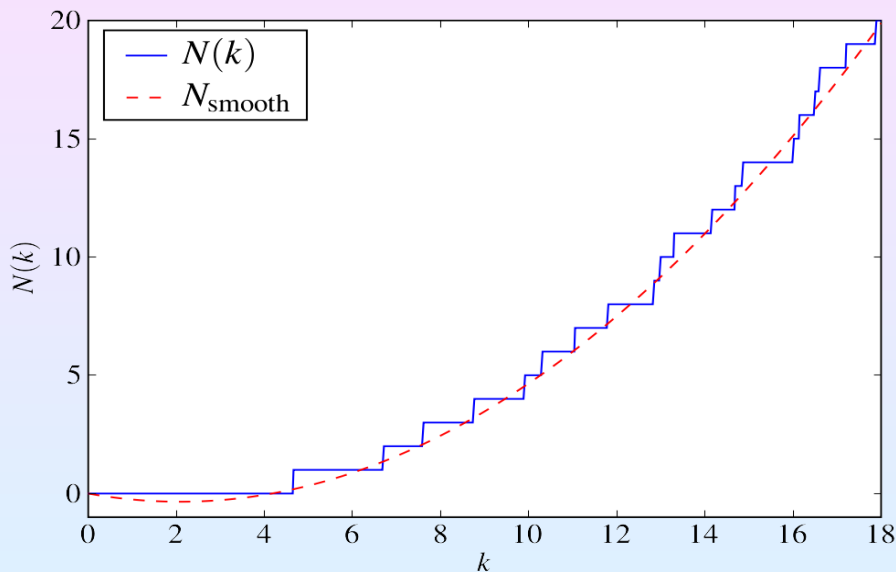
הספקטרום של תוף מעגלי



The spectrum of a drum



- The spectrum is analyzed using a step function



- The smooth part of the function has a shape of a parabola:

$$N_{\text{smooth}}(k) = \frac{A}{4\pi} k^2 - \frac{L}{4\pi} k$$

A – area ; L -circumference

“Personally, I believe that one cannot *hear* the shape, but I may well be wrong and I am not prepared to bet large sums either way.” (Kac)

So ... Can one hear the shape of a drum ?