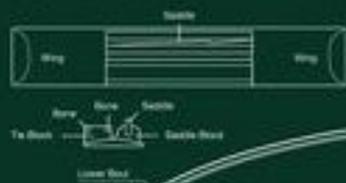


# Использование законов физики в музыке



## SADDLE AND BRIDGE

The bridge and saddle transfer vibrations from the strings to the soundboard. The saddle is made from bone or plastic, and is compensated to provide proper intonation. It determines string height and effective length. The bridge is usually made from a single piece of rosewood or ebony. It consists of a saddle block that houses the saddle, and a deck block into which strings are tied. The bridge is also braced with bars on both sides to prevent the strings from distorting the wood and often contains a decorative inlay. Wings on either side of the bridge transfer the pulling force from the strings to the soundboard.

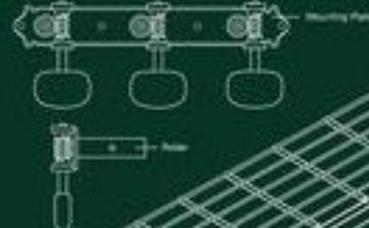


## Soundboard Bracing Patterns



## HEADSTOCK AND TUNING MACHINES

The headstock is attached to the top of the neck, and holds the nut, and contains the tuning machines. The neck and headstock are often carved from a single piece of wood. They are also braced together with a head plate. The weight and length of the headstock affect the sound of the guitar. It is shaped to hold the strings body pressure on the nut. Classical guitar headstocks are usually locking. The tuning machine refers. The tuning machines are mounted on the sides and use gears and worm gears to provide precise and stable tuning. Often, tuning machines are cast in three on a single mounting plate. A hardened washer is often glued to the back of the headstock to reinforce the headstock and cover up any exposed grain ends.

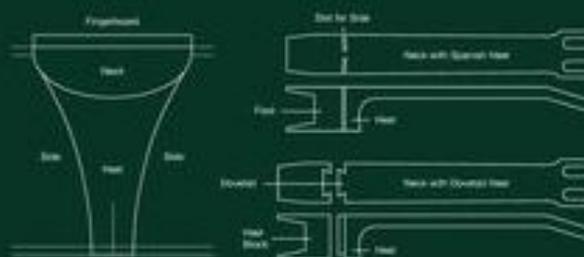


## NUT

The nut is located at the top of the fretboard at the base of the headstock. It determines string spacing and height at the zero fret. The nut is made from bone or plastic and is compensated to ensure proper action and intonation. The string slots are cut into the nut and are often filled with a lubricant to reduce friction and wear.

## STRINGS

The highest three strings on the guitar are made from nylon. Traditionally, these strings were made from gut. These strings are made from two nylon filaments twisted in opposite directions to form a rope. The lowest three strings are made from steel. They are made from a single wire or a twisted wire. The strings are made from a variety of materials, including steel, nylon, and gut.



Выполнил: Леонов Юрий  
Алексеевич,  
учащийся 11 класса

# Цель:

- ИЗУЧИТЬ С ТОЧКИ ЗРЕНИЯ ФИЗИКИ ОДИН ИЗ ВИДОВ МУЗЫКАЛЬНЫХ ИНСТРУМЕНТОВ – ЩИПКОВЫЕ СТРУННЫЕ

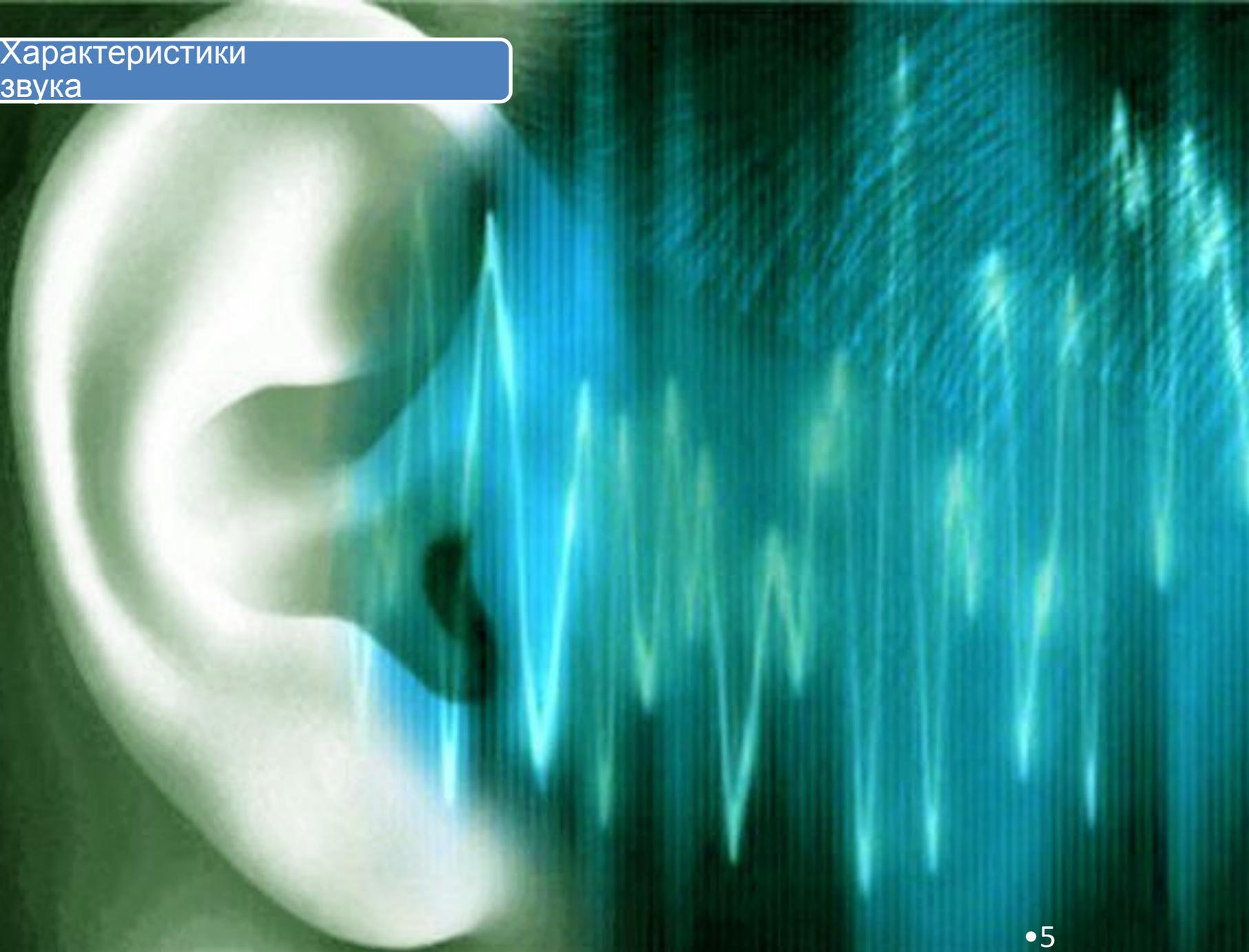
# Задачи:

- изучить литературу по теме проекта
- изучить процесс формирования стоячей волны в струне

# Актуальность:

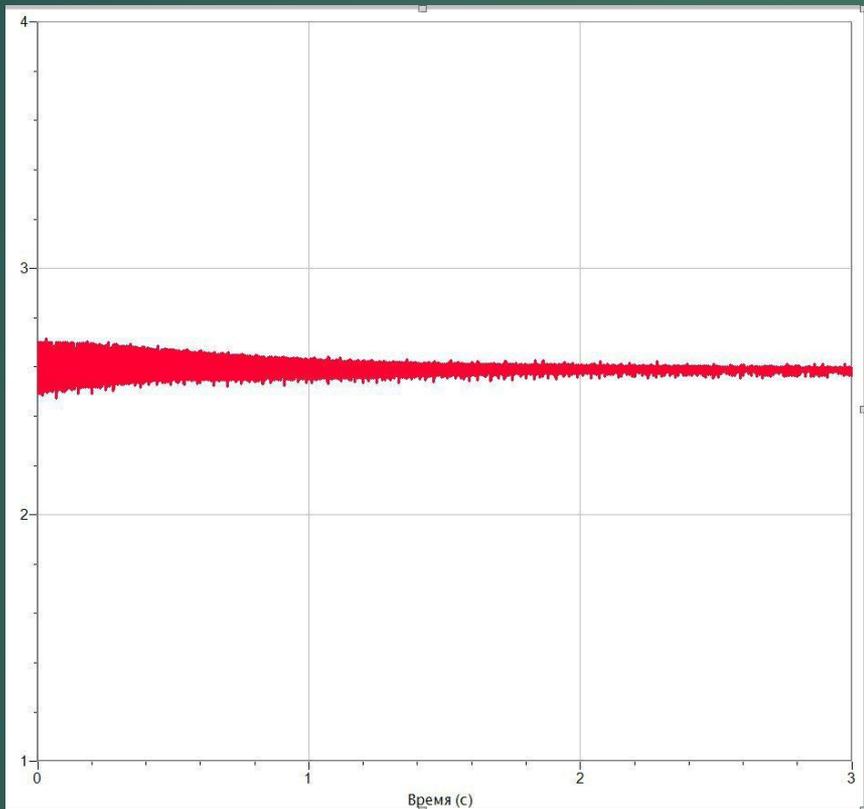
- полученные в ходе исследования знания можно использовать при сочинении и исполнении музыки.

# Характеристики звука

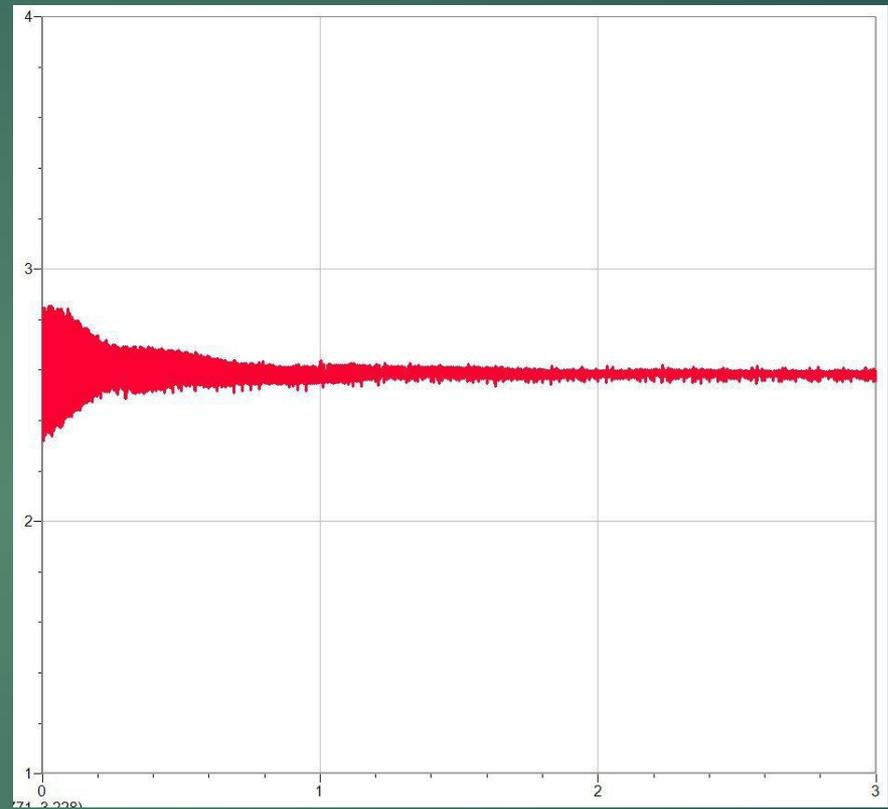


Handwritten text in a cursive script, possibly representing a name or a signature, written in white or light-colored ink on a dark background.

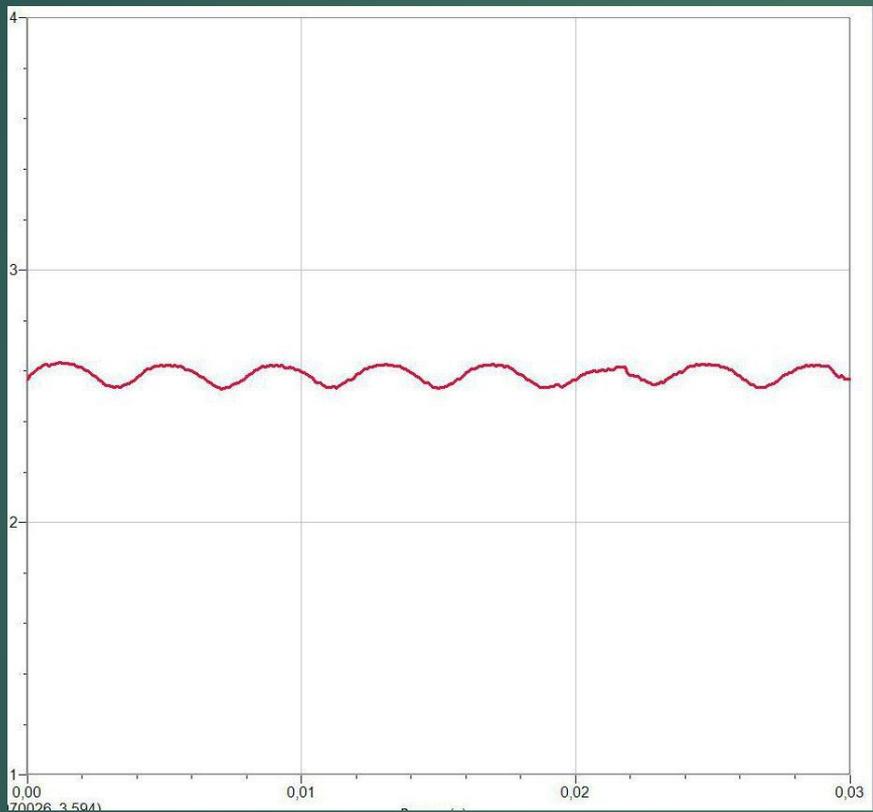




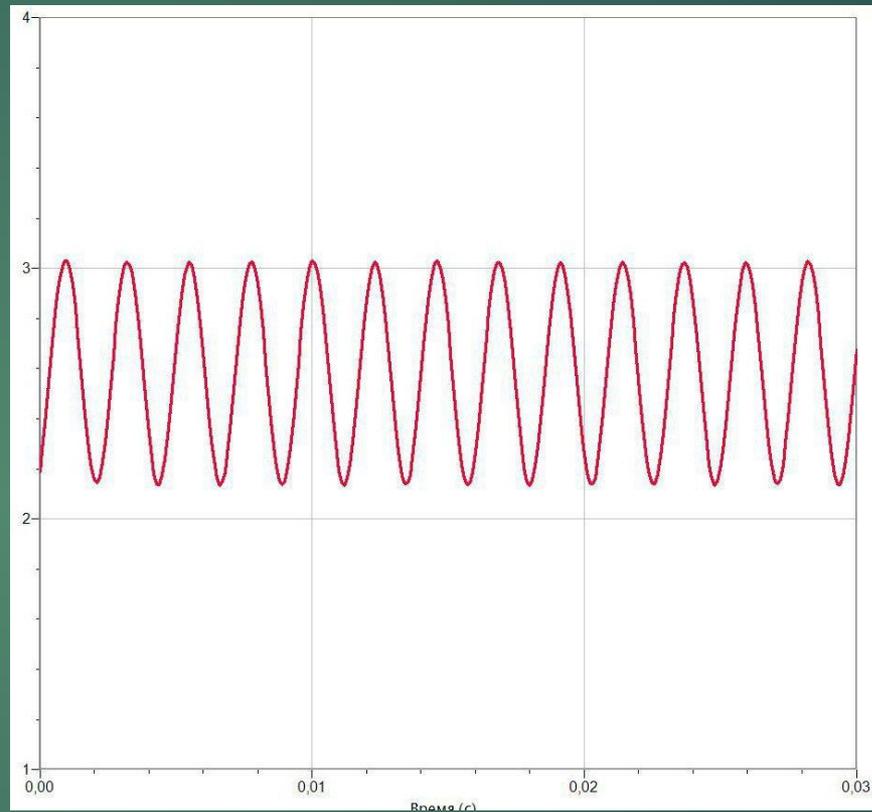
Слабый удар



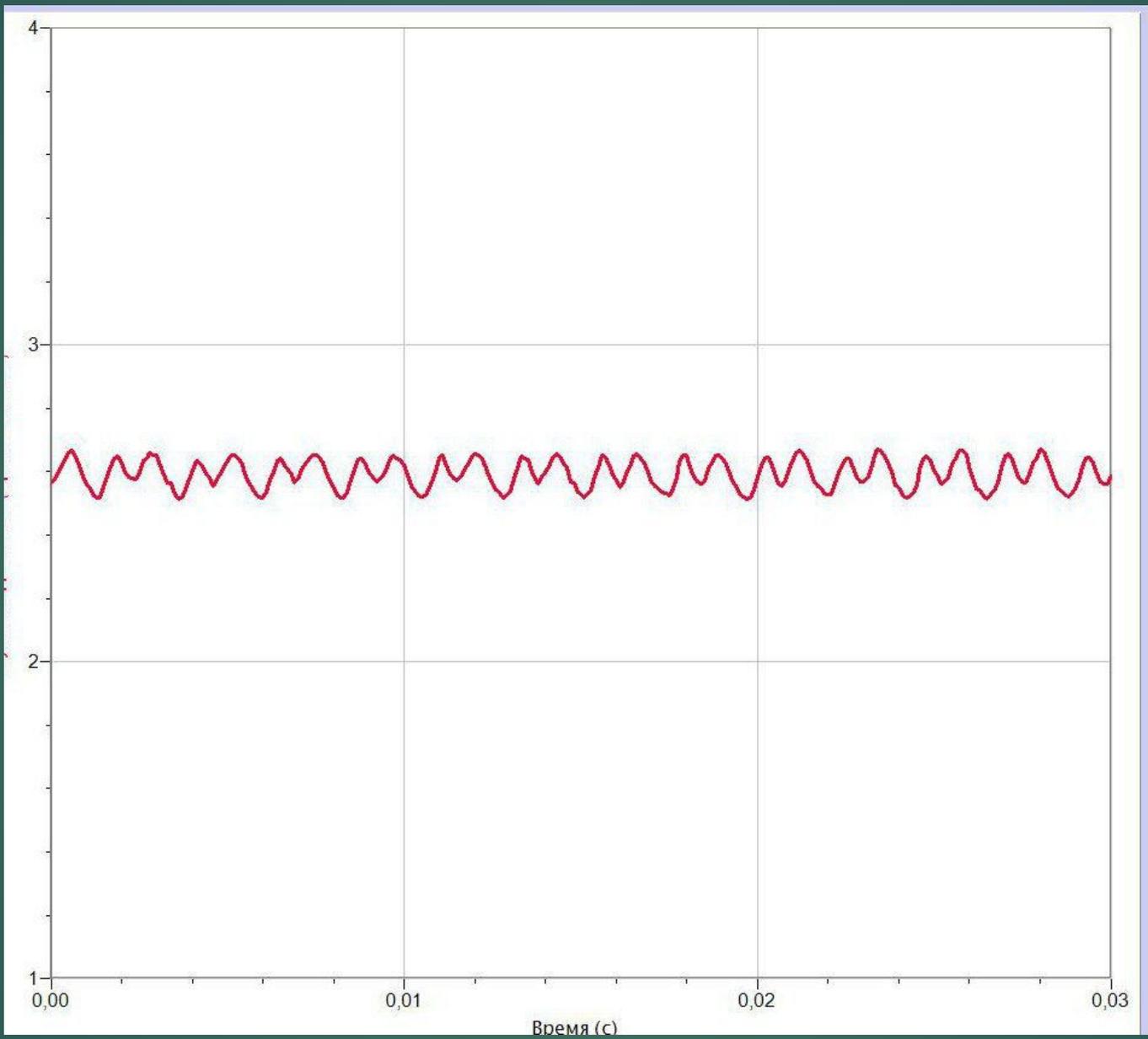
Сильный удар



56 Гц

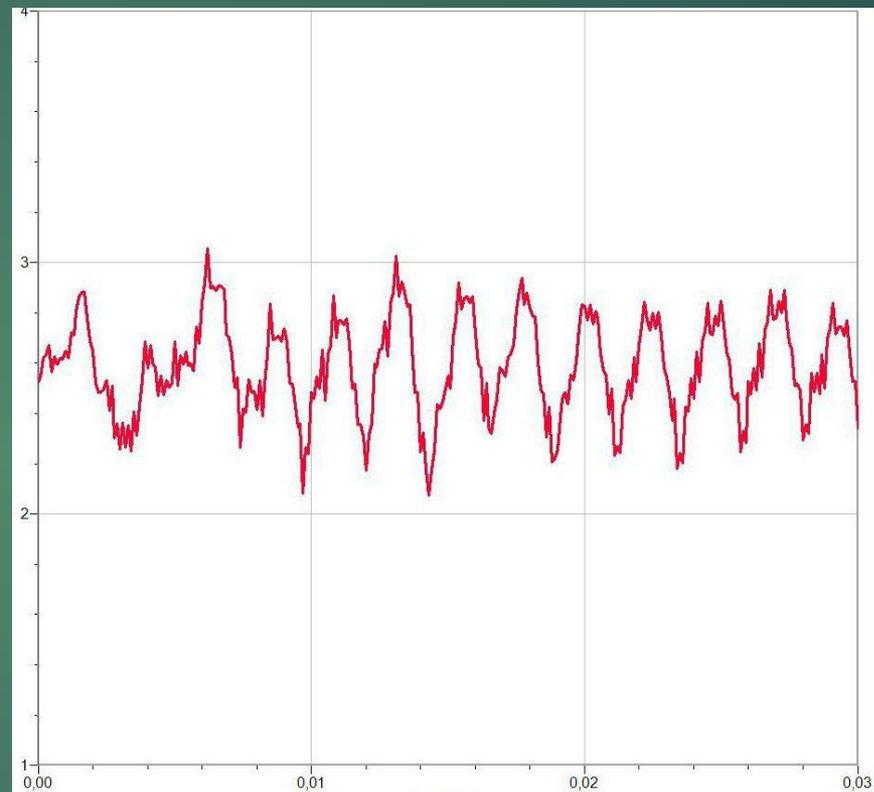
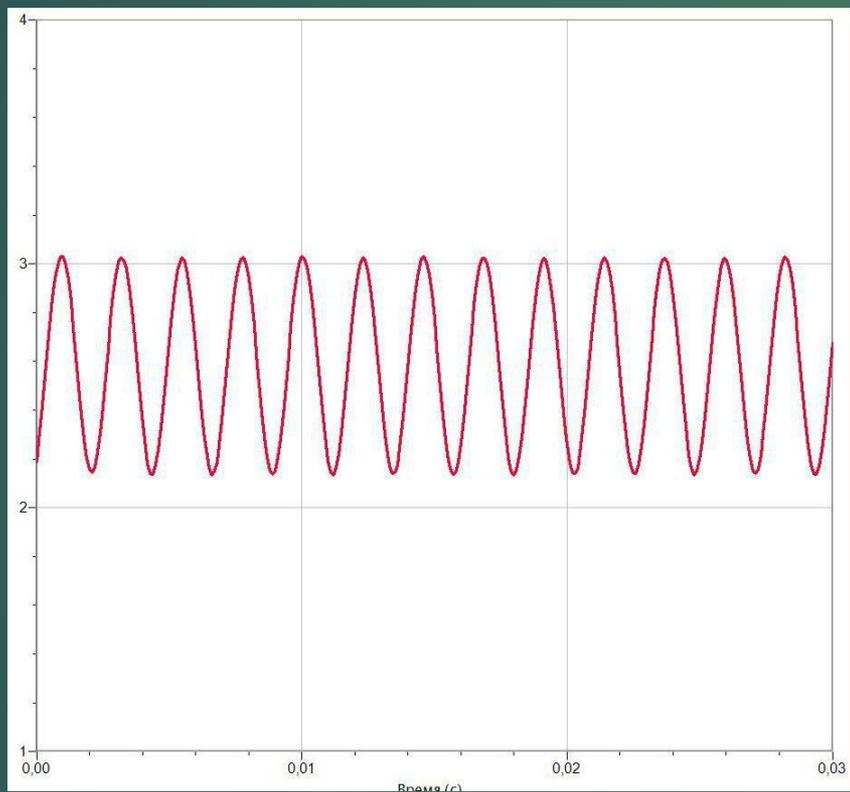


440 Гц

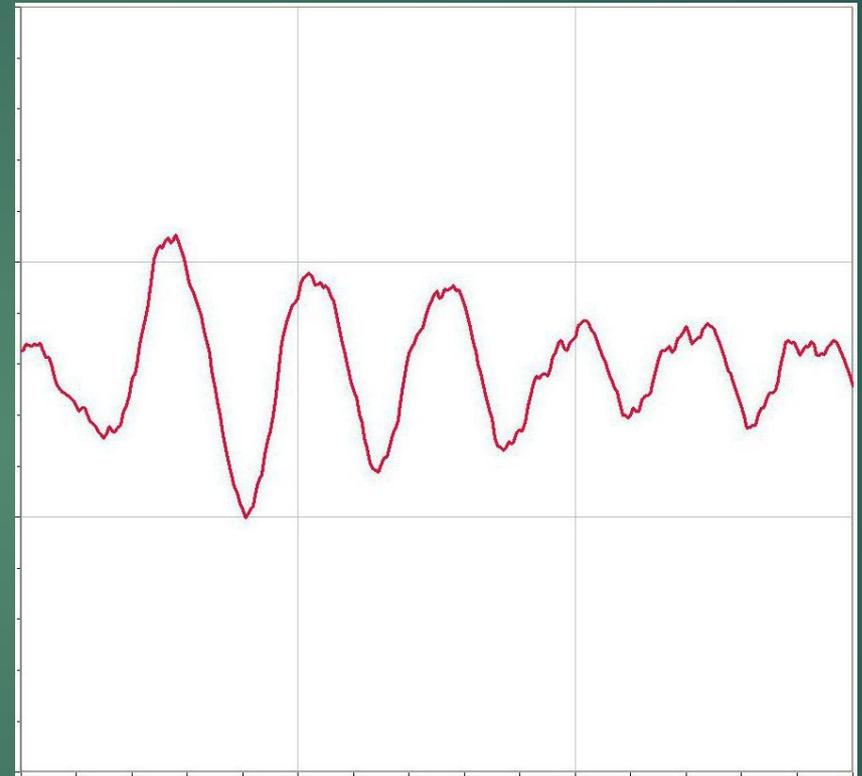
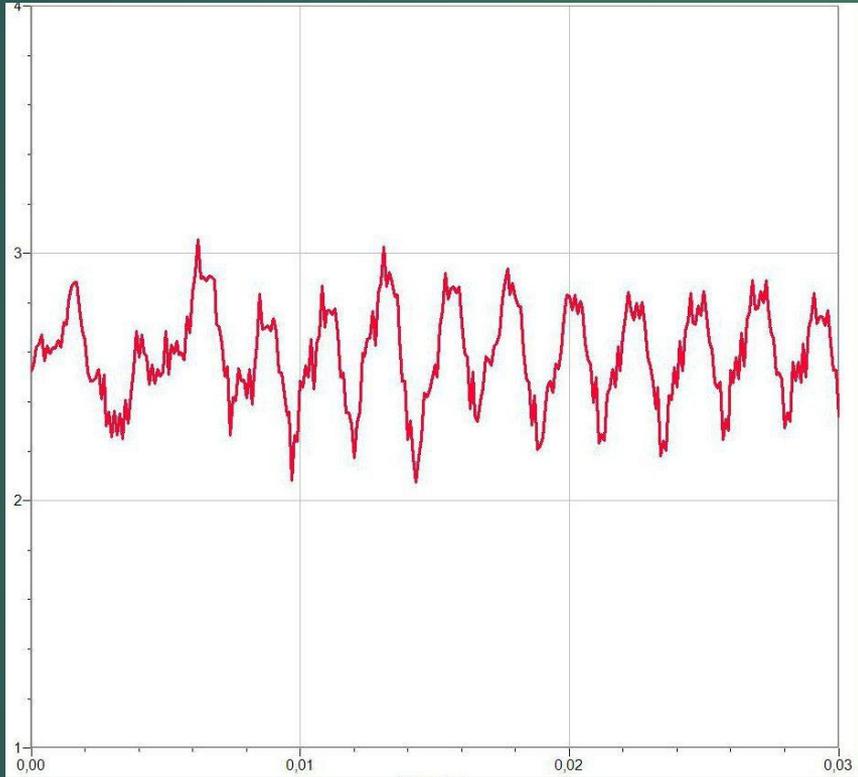


## О струнах



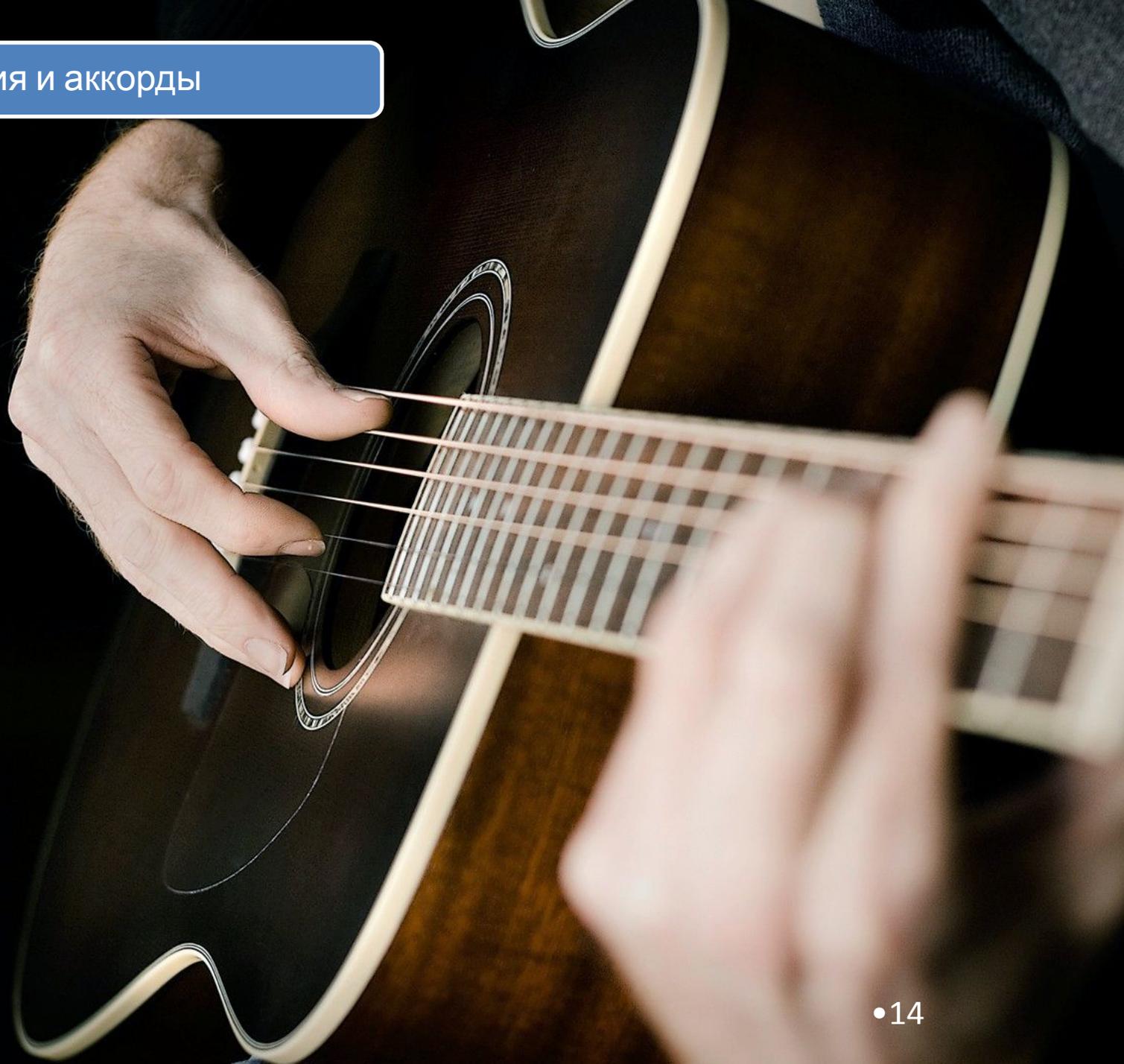


Нота Ля на камертоне и на  
гитаре



Нота Ля на гитаре. Интервал  
октава

## Ноты, созвучия и аккорды



# Интервалы и соотношения

## Частот

до-до диез  $277,2 : 261,7 = 1,059\dots$

до-ре  $293,7 : 261,7 = 1,122\dots$

до-ре диез  $311,1 : 261,7 = 1,188\dots 1,2 = \mathbf{6 : 5}$

до-ми  $329,6 : 261,7 = 1,259\dots 1,25 = \mathbf{5 : 4}$

до-фа (кварта)  $349,2 : 261,7 = 1,310\dots \mathbf{4 : 3}$

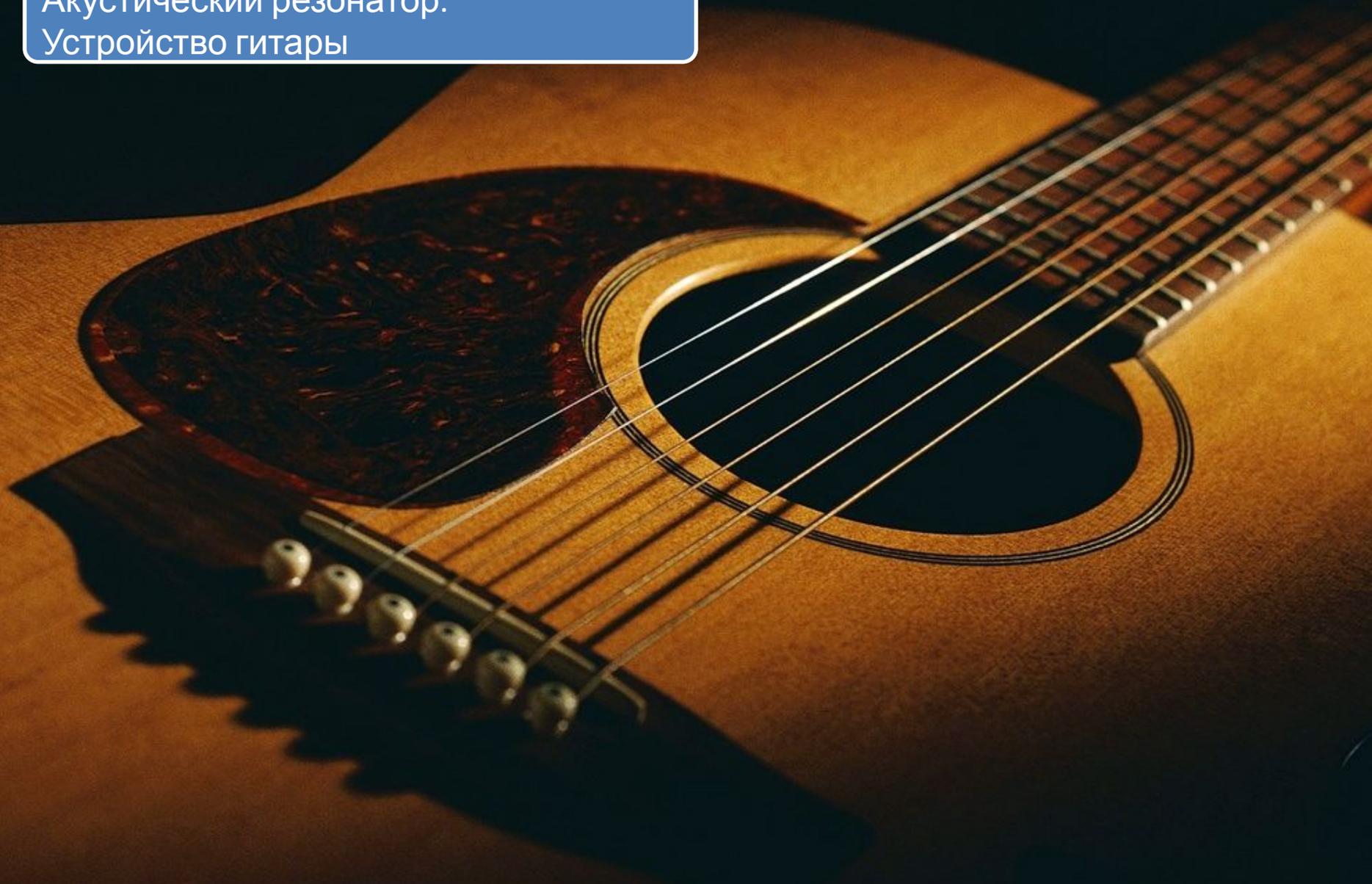
до-соль (квинта)  $392,0 : 261,7 = 1,498\dots 1,5 = \mathbf{3 : 2}$

до-ля  $440,0 : 261,7 = 1,681\dots$

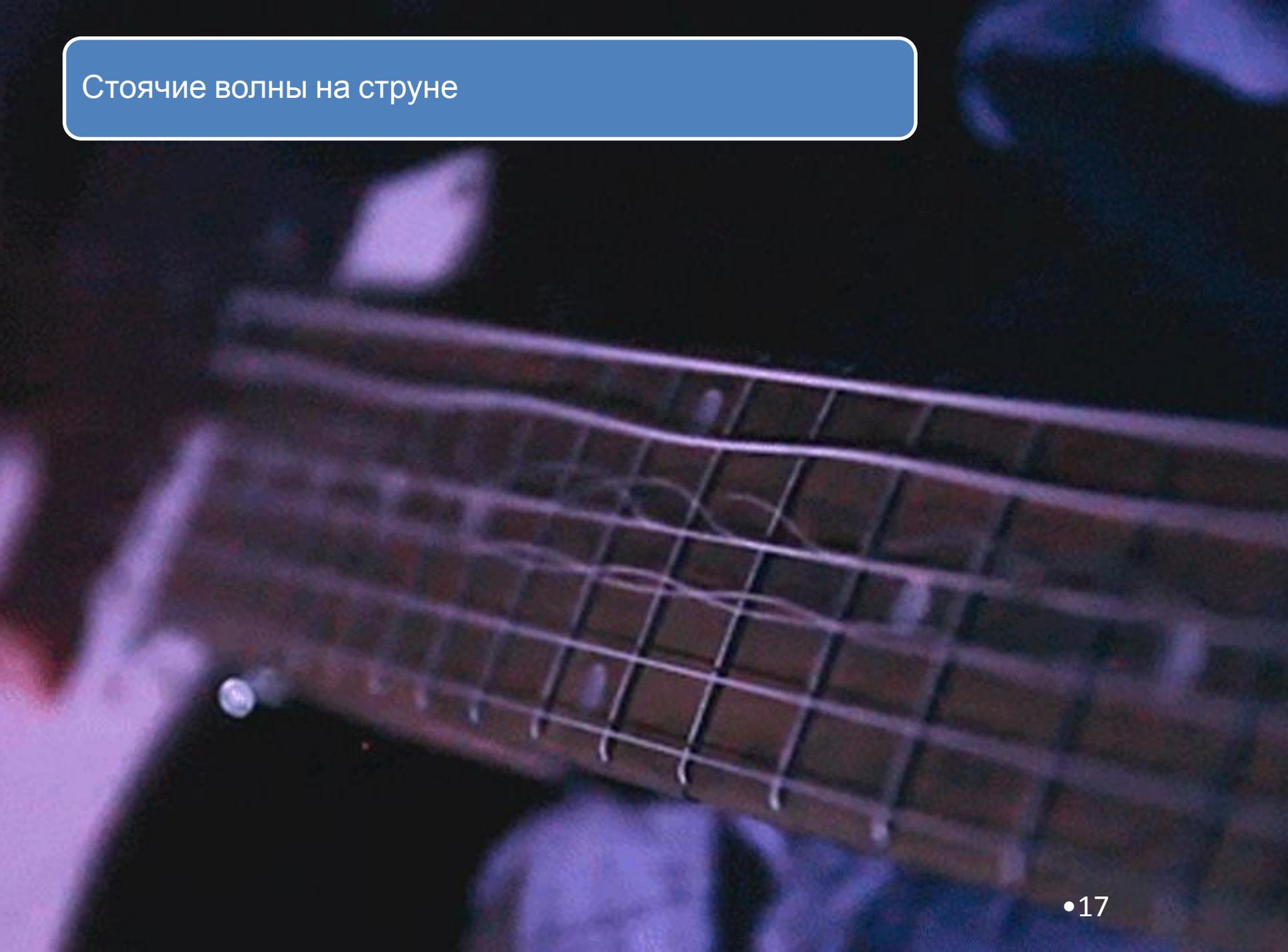
до-си  $493,9 : 261,7 = 1,887\dots$

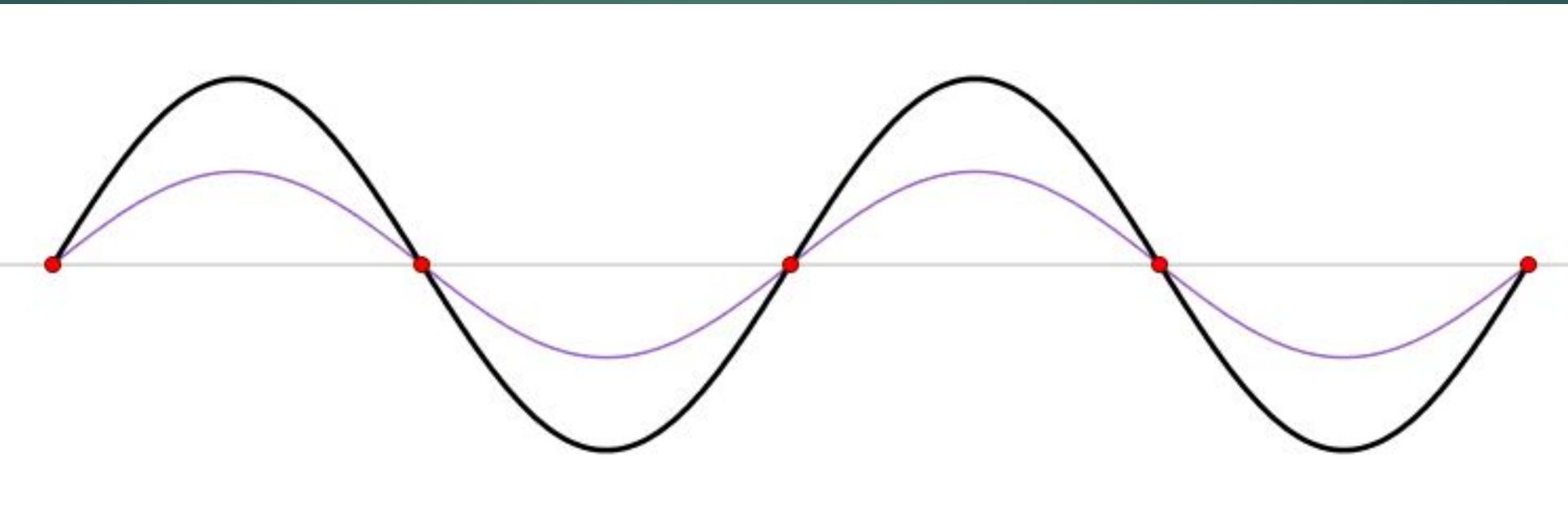
до-до (октава)  $523,4 : 261,7 = \mathbf{2 : 1}$

Акустический резонатор.  
Устройство гитары

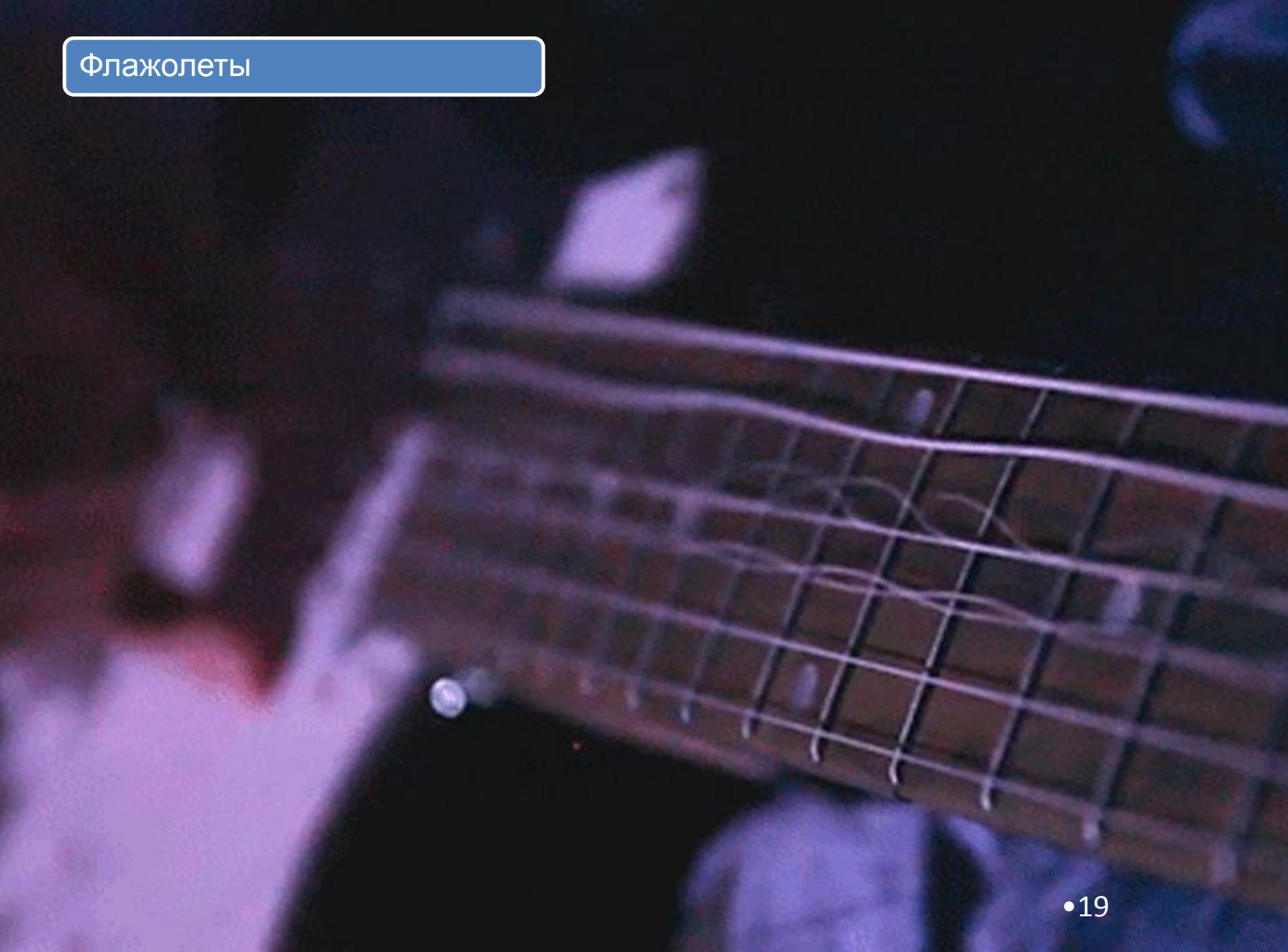


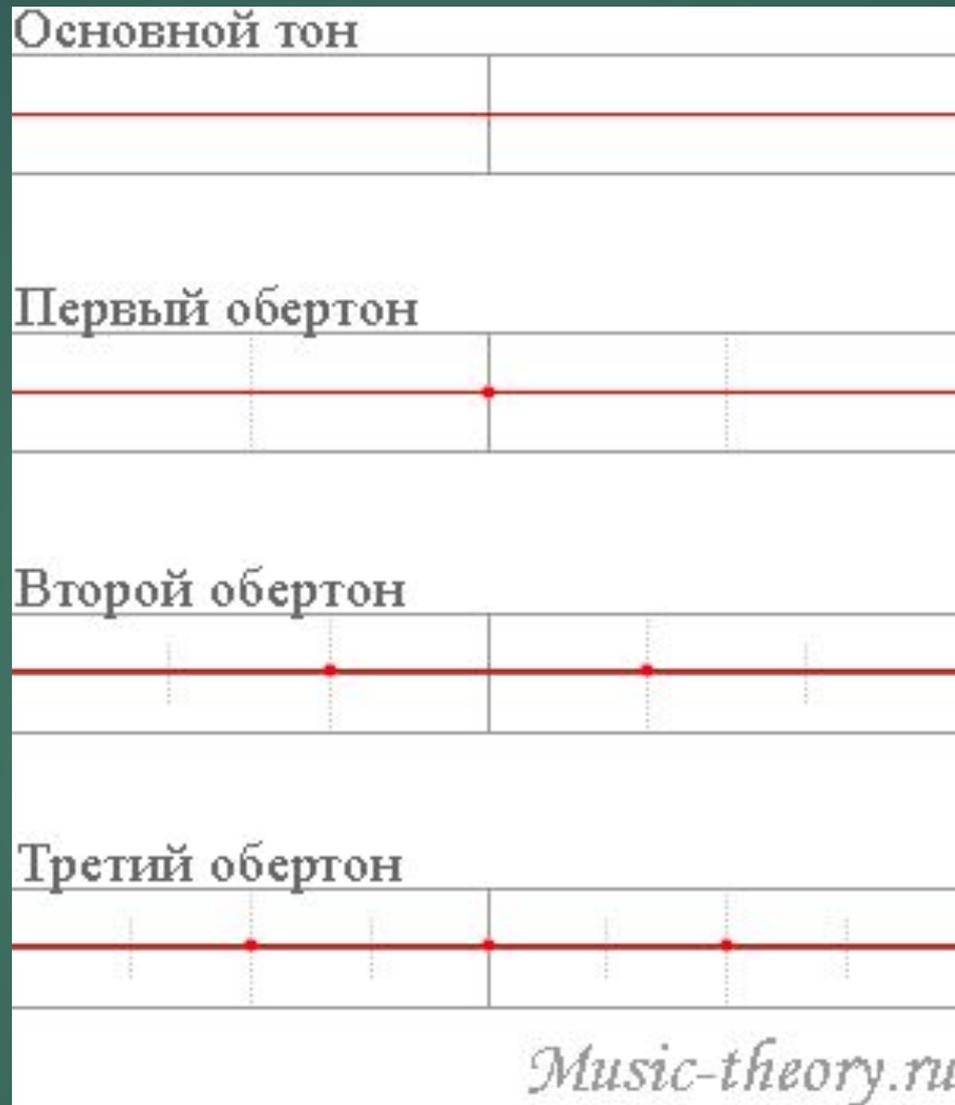
## Стоячие волны на струне



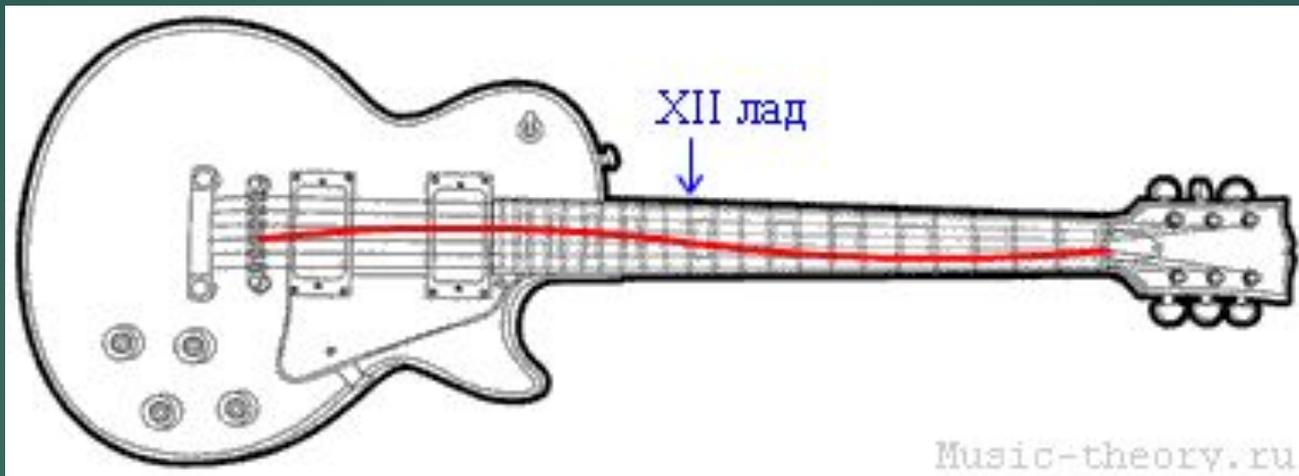


# Стоячая волна

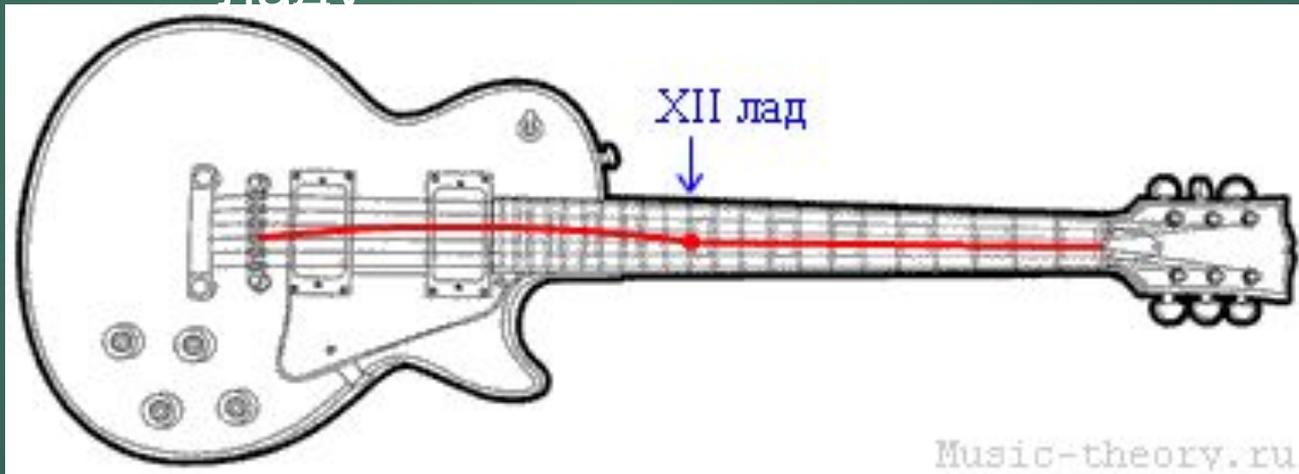




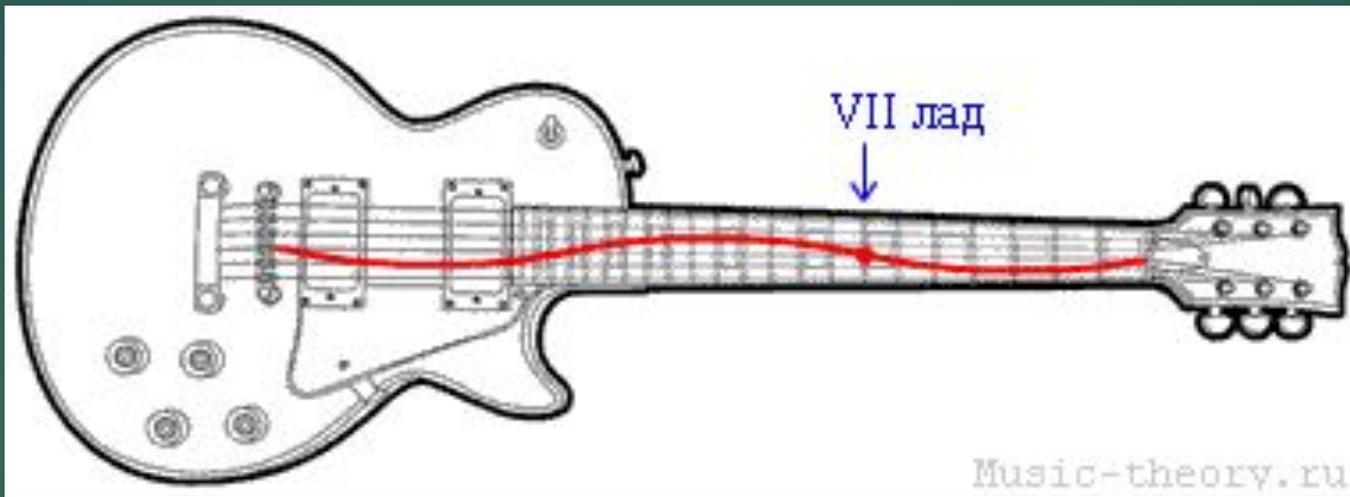
# ОСНОВНОЙ ТОН И ОБЕРТОНЫ



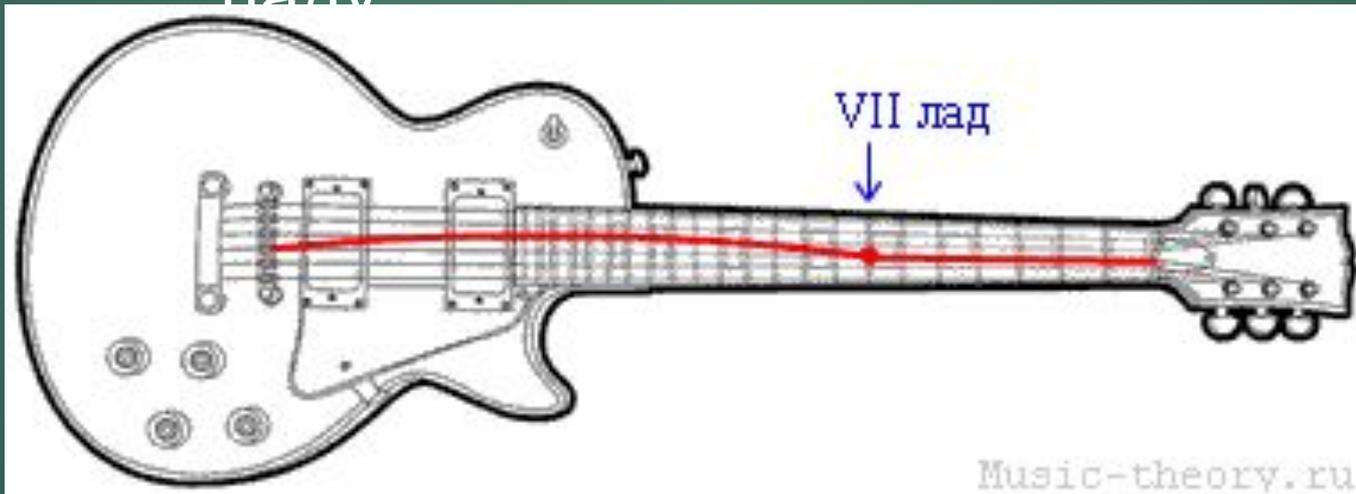
Натуральный флажолет на XII  
палу



Колебания струны, прижатой на XII  
ладу



Натуральный флажолет на VII ладу



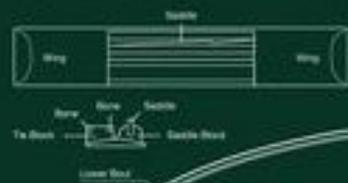
Колебания струны, прижатой на XII ладу

# Использование законов физики в музыке



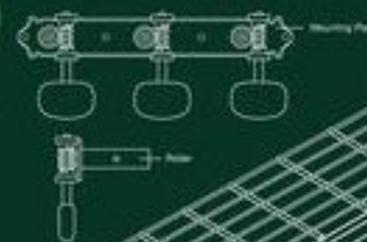
## SADDLE AND BRIDGE

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## HEADSTOCK AND TUNING MACHINES

The headstock is attached to the top of the neck, and contains the tuning machines. The neck and headstock are often carved from a single piece of wood. They are also braced together with a head plate. The weight and length of the headstock affect the sound of the guitar. It is shaped to house the strings body pressure on the nut. Classical guitar headstocks are usually locking. The tuning machine refers. The tuning machines are mounted on the sides and use gears to provide precise and stable tuning. Often, tuning machines are cast in brass on a single mounting plate. A hardened washer is often glued to the face of the headstock to reinforce the headstock and cover up any exposed grain ends.

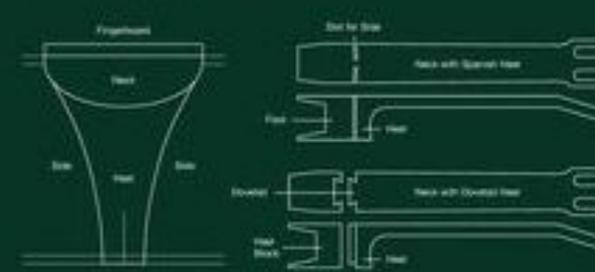


## NUT

The nut is located at the top of the fretboard at the base of the headstock. It determines string spacing and height at the zero fret. The nut is made from bone or plastic and is compensated to ensure proper action and intonation. The string sits in the slot and rests on the saddle. The nut is also braced to prevent the strings from distorting the wood and often contains a decorative inlay. Wings on either side of the bridge transfer the pulling force from the strings to the soundboard.

## STRINGS

The highest three strings on the guitar are made from nylon. Traditionally, these strings were made from gut. These strings are made from two nylon filaments twisted in opposite directions to form a rope. The lowest three strings are made from steel. They are made from a single wire or a twisted wire. The strings are made from a single wire or a twisted wire. The strings are made from a single wire or a twisted wire.



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Алексеевич,  
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