



UN'ESPERIENZA CLIL AL LICEO SCIENTIFICO RIFORMATO:

SPECIAL RELATIVITY

E.BACCAGLINI

LSP Cairoli - Torino

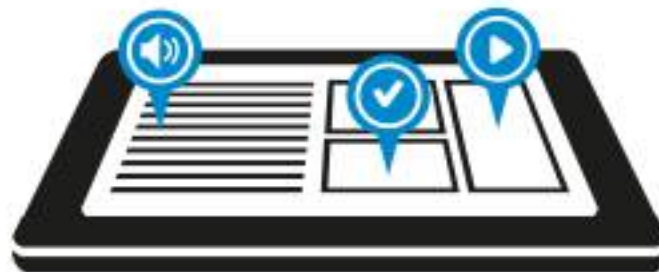
DI.FI.MA. 2015- Torino

AGENDA

- Normativa e autenticità del contesto
- Il piano didattico
- I materiali
- Risultati dell'apprendimento
- Considerazioni e sviluppi futuri

NORMATIVA E AUTENTICITÀ DEL CONTESTO

- Con l'A.S. 2014/2015 sono diventate operative le norme inserite nei Regolamenti di riordino (DPR 88 e 89/2010) che prevedono l'obbligo, nel quinto anno, di insegnare una **disciplina non linguistica** (DNL) in lingua straniera (L2) secondo la **metodologia CLIL** (Content and Language Integrated Learning).
- **Autenticità del contesto:** la lingua di comunicazione della scienza è l'inglese ed è sembrato quindi opportuno promuovere l'apprendimento di una porzione della Fisica in questa lingua, anche in considerazione della grande disponibilità di materiale *on line*.







FINALITÀ

- **acquisizione dei contenuti** disciplinari
- miglioramento della **competenza comunicativa** nella L2
- utilizzo di **L2 come strumento** per apprendere

PIANO DIDATTICO

- Inconciliabilità tra Meccanica Classica ed Elettromagnetismo
- Postulati di Einstein
- Il concetto di simultaneità
- La contrazione delle lunghezze e dilatazione degli intervalli di tempo
- Il paradosso dei gemelli
- Le principali conferme sperimentali

Get started...

Symbol	How to read it	Example	Listen
100 1000 1,000,000 1,000,000,000	one hundred one thousand one million one billion	1,184,712 One million, one hundred eighty-four thousand, seven hundred and twelve <i>Watch out: "hundred", "thousand", "million" are always read as singular, never as plural</i>	
, <i>A comma is used to separate hundreds from thousands form millions etc.</i>	comma	<i>Not pronounced</i> 3,544 Three thousand five hundred and forty-four	
. <i>In English decimal points are written as dots, not as commas.</i>	point	2.56 Two point five six <i>Watch out: decimals must be read separately</i>	
+	plus	23 + 5 twenty-three plus five	

STRATEGIE

- Le lezioni sono state focalizzate sui contenuti e sulla lingua.
- Nel corso del modulo, sono state attuate le **tipiche strategie CLIL** (brainstorming, cooperative learning, attività mirate ad aumentare la produzione autonoma etc.).

in classe a coppie

WoV! (work on the vocabulary)

Match each word with the definition.

Dilation	Absence of matter
Contraction	A time-invariant quantity, such as a constant position or temperature
Reference frame	A set of coordinate axes in terms of which position or movement may be specified
Inertial frame	The act of expanding
Galilean transformation of coordinates	Relation between the coordinates of an event as observed from two inertial reference frames
Medium	An intervening substance through which something is transmitted or carried on.
Ether	The coordinate system in which the particle is at rest
Vacuum	A reference system in which the Newton's 1st law is valid
Simultaneity	Any of the subatomic particle that compose matter and energy
Elementary particle	Happening at the same time
Rest frame	An all-pervading, infinitely elastic, massless medium
Stationary	The act of contracting

STRATEGIE

Listen up!



in classe autonomamente



Listen to the following excerpt, then complete the sentences below by adding the missing terms.

- Someone moving at relative to someone else would look to the as if he was in the opposite and at the same speed.
- The knowledge gained during the last of the 19th century gave more than an to the possibility that light adhere to relativity.
- The greatness of was that he to understand that it is possible to relativity with the notion of speed of light. Time is, is relative.
- The general rules of relativistic location and have been by equations called equations.
- Energy equal to the factor multiplied by and the speed of light While fast things have a lot of energy, when they are (Lorentz factor of), they some energy. It seems that everything has just by having Releasing or energy, by the way, the mass.

Hands on! ...it's your turn!

in classe autonomamente

First carefully study the proposed exercise, and then solve the others.

An astronaut travels at a speed of $0.9c$ for 5 years, measured by the instruments onboard the spacecraft. How long does the journey take measured by an observer on Earth? **[11 years]**

The 5 year time interval is the proper time interval Δt , in that it is measured by instruments onboard the spacecraft. The time measured by an observer on Earth $\Delta t'$ is thus:

$$\Delta t' = 1 / \sqrt{1 - v^2/c^2} = 1 / \sqrt{1 - 0.9^2} \approx 1.48 \text{ years} \approx 11 \text{ years}$$

- 6** A space probe has completed a journey that lasted 10 years, measured by the instruments onboard the spacecraft. For an observer on Earth the journey lasted 15 years. How fast was the probe travelling? **[0.75 c]**

STRATEGIE

3.3 Criticism of the concept of simultaneity



To overcome the contradiction between the invariance of c and the classical law for the addition of velocities, the Galilean transformation equations, based on the reciprocity of motion and absoluteness of time, had to be rewritten.

Newton had already defined the latter concept as *something that from its own nature flows equably without relation to anything external*. Einstein questioned the actual concept of absolute time starting from a crucial premise: **simultaneity**.

In order to discuss this in physical terms, we need an operational definition of simultaneous events.

In a reference frame K , an **event** $P(x, y, z, t)$ is defined by a space-time curve in which the first three coordinates, x, y, z indicate the position in K and t indicates the instant in which the event occurred, measured by a clock at rest in relation to K .

event



studio domestico

STRATEGIE

CHECKPOINT!

True or false?

- 1 The principle of Galilean relativity states that the same laws of mechanics apply in a reference frame K and in a frame K' moving with uniform linear motion in relation to K . **T F**
- 2 The Michelson-Morley experiment demonstrated the existence of the ether frame. **T F**

Now **complete the following sentences** by adding the missing terms

V



- 3 According to the principle of Galilean relativity, all reference frames are equivalent. This means that if a law of mechanics applies in one reference frame K , it must apply in all reference frames moving with motion in relation to K .

Hands on! ...it's your turn!

W

S

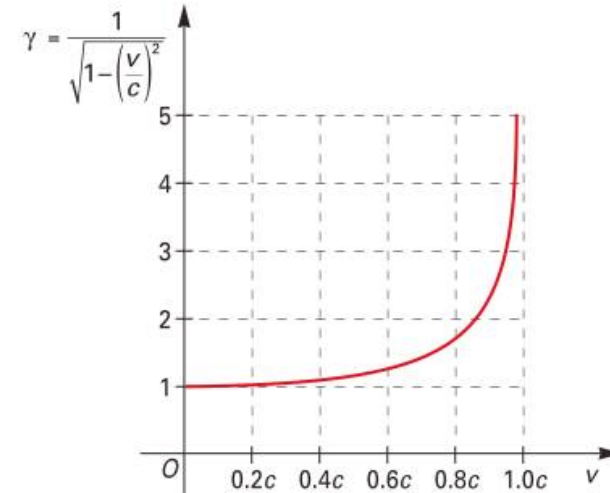
Answer in 15 lines then share your work with your classmates and submit the final version to the teacher.

- 4 Describe the principles proposed by A. Einstein to solve the contradiction concerning the speed of light in classical mechanics and electromagnetics.

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TEMPI E RISULTATI DELL'APPRENDIMENTO

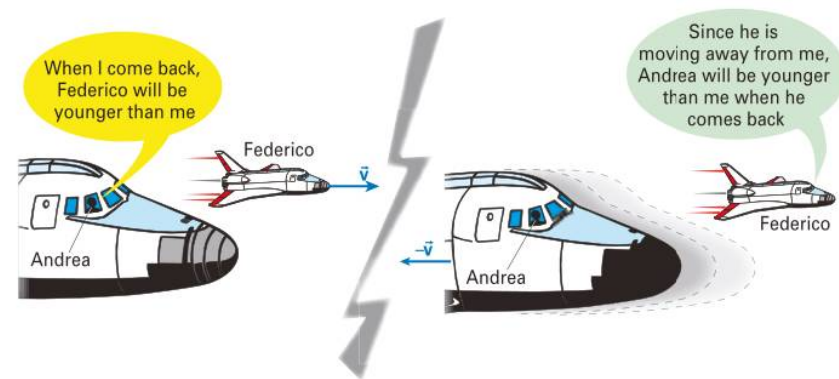
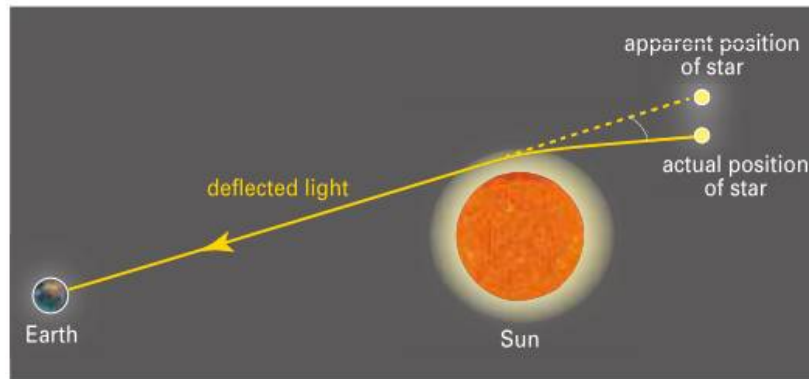
- 9 ore «lezione»
- 1 simulazione di III prova
- 1 interrogazione orale
- 1 valutazione compiti



- I risultati raggiunti evidenziano un'**elaborazione profonda delle informazioni** trasmesse (es. il paradosso non sta nel fatto che uno dei due gemelli invecchi più dell'altro...).
- Questo approccio ha probabilmente anche aiutato gli studenti a comprendere che **la lingua è uno strumento di comunicazione, acquisizione e trasmissione** del sapere e non un'astratta entità regolata da grammatica e sintassi.

CONSIDERAZIONI FINALI

- Argomento adatto ad una presentazione in L2: molto discorsivo, poche «formule»
 - i ragazzi riescono a concentrarsi sui contenuti più facilmente
- Grande interesse per le questioni trattate
 - temi attuali e «intriganti» che facilitano la discussione in aula (in L2)





GRAZIE!

Enrico Baccaglini

ebacca79@gmail.com