

# The SpokenMedia Project:

## Toward Rich Media Notebooks for Teaching and Learning

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Office of Educational  
Innovation and Technology



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# Why are we doing this?



[MIT OCW 8.01](#): Professor Lewin puts his life on the line in [Lecture 11](#) by demonstrating his faith in the Conservation of Mechanical Energy.

- More & more videos on the Web
  - Universities recording course **lectures**
  - **Students** (and universities) **relying** upon Web video for **learning**

# What are the challenges?

- Search
  - Volume
  - Segmented by Web, Video
  - Text title and Description

Google Search for  
“angular momentum”  
Performed April 2009

Web Images Maps News Video Gmail more ▼

Google Video BETA

angular momentum Search Videos Search the Web Advanced Video Search Preferences Moderate SafeSearch is on

Search: ☒ all videos ☐ videos playable on Google

From: All dates Duration: All Results 1 - 10 of about 402 for angular

Also try: [mechanical universe](#)

**Caltech: The Mechanical Universe - 19 - Angular Momentum**  
28:51 - 1 year ago - ★★★★★ - [video.google.com](#)

**What Is The Conservation Of Angular Momentum?**  
02:06 - 6 months ago - ★★★★★ - [metacafe.com](#)

**Tennis Lessons - how to use angular momentum**  
04:34 - 6 months ago - ★★★★★ - [graspr.com](#)

**MIT Physics Lecture: Classical Mechanics - 21 - Torques ...**  
47:52 - 1 year ago - ★★★★★ - [video.google.com](#)

**What is the conservation of angular momentum?**  
02:05 - 2 years ago - ★★★★★ - [youtube.com](#)

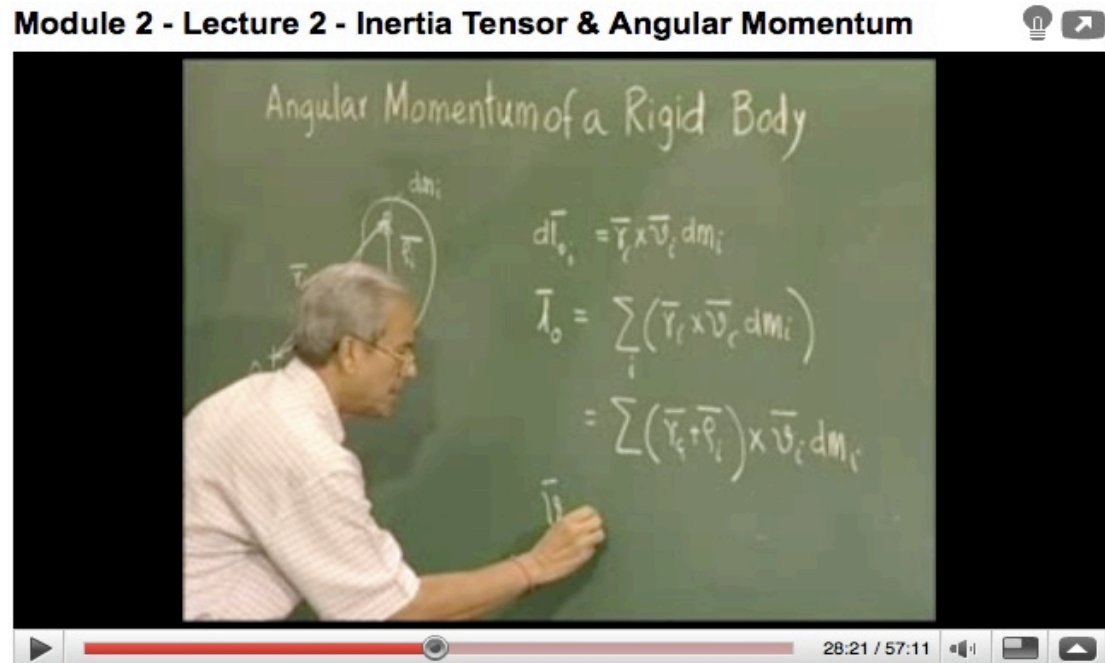
**fahrradreifen drehimpuls physik angular momentum physics**  
00:23 - 1 year ago - ★★★★★ - [youtube.com](#)

**Caltech: The Mechanical Universe - 19 - Angular Momentum**  
28:51 - Feb 23, 2008 - ★★★★★ (3 Ratings) - Rate: ★★★★★  
Watch this video on [video.google.com](#)

This series helps teachers demystify physics by showing students what it look hot-air balloon events, symphony concerts, bicycle shops, and other locales n

# What are the challenges?

- Interaction & Use
  - Full video vs. Segments
  - Does transcript or captioning exist?



Ghosh, A. (2008). Module 2–Lecture 2–Inertia Tensor & Angular Momentum. Retrieved August 1, 2009 from YouTube Website: <http://www.youtube.com/watch?v=a9n2Ztp1Oic>

# What about Bing?

Bing Search for "angular momentum" Performed August 2009

Web Images Videos News Maps More MSN Hotmail Sign in Extras

bing Beta

angular momentum

ALL RESULTS

Videos

VIDEOS 1-20 of 2,420 results

sort by: best match | most recent

LENGTH

- short (< 5 min)
- medium (5-20 min)
- long (> 20 min)

SCREEN TYPE

- standard
- widescreen

RESOLUTION

- low
- medium
- high

SOURCE

- msn
- youtube
- rajshri
- rediff
- ibnlive
- dailymotion
- mtv

Angular Momentum Time Pieces TENDANCE...  
Dailymotion 2:11

Angular Momentum est une société...  
Dailymotion 3:19

Angular Momentum 1 TENDANCE MAGAZINE TV  
Dailymotion 2:19

Angular Momentum Time Pieces TENDANCE...  
Dailymotion 2:09

Angular Momentum 10e ANNIVERSAIRE - 2008...  
Dailymotion 2:29

Dr. Carlson's Science Theater  
Angular Momentum - Science Theater 24  
YouTube 4:59

Geomag & Physics: Angular Momentum...  
YouTube 1:19

Angular Momentum Demos  
YouTube 6:01

Fun with Physics - Angular Momentum

Conservation of Angular Momentum

What is the conservation of angular

DEMO: Conservation of angular momentum



# Why do we want these tools?

## MIT OpenCourseWare Lectures

- **Improve search** and retrieval
- What do we have?
  - Existing videos & audio, new video
  - Lecture notes, slides, etc. (descriptive text)
  - Multiple videos/audio by same lecturer (scale)
  - Diverse topics/disciplines
- **Improve presentation and user experience**
- Captioning for accessibility
- Facilitate translation, other uses?

# What can we do today?

[web.sls.csail.mit.edu/lectures/](http://web.sls.csail.mit.edu/lectures/)

- Spoken Lecture Browser
  - Requires Real Player 10



# Lecture Browser

SPOKEN LANGUAGE SYSTEMS

MIT COMPUTER SCIENCE AND ARTIFICIAL INTELLIGENCE LABORATORY

Search for words: and/or pick a category:

angular momentum

Any category

Search

Examples: violin, "solar system", wine AND glass

50 results for angular momentum

## 1. Angular Momentum, Torques, Conservation of Angular Momentum, Spinning Neutron Stars, Stellar Collapse

Lecture 20, Physics I: Classical Mechanics, Physics, MIT, 1999 (Walter Lewin)

51:05



- ▶ we're now answering the part of eight oh one which is the most difficult for students and faculty alike ... we are going to enter the domain of angular momentum and forks it's extremely non intuitive ... the good news however is that b will stay with this concept for at least four five lectures today i will
- ▶ the good news however is that b will stay with this concept for at least four five lectures today i will introduce both fork an angular momentum ... what is angular momentum if an object has a mass  $m$  ... and it has a velocity  $v$  ... then clearly it has a momentum ...  $v$  that's very well defined your reference frame the product of  $m$  and  $v$  ... thank the momentum ... i can take relative to any point i choose i choose this point  $q$  arbitrary ... this now ... is the position
- ▶ this now ... is the position vector which i call our of  $q$  ... but this angle buffet to ... an angular momentum relative to that point  $q$  it's a vector or ... is the position vector relative to that point  $q$  cross  $p$

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[web.sls.csail.mit.edu/lectures](http://web.sls.csail.mit.edu/lectures)



# How do we do it?

## Lecture Transcription

James Glass  
glass@mit.edu



- Spoken Lecture: research project
- Speech recognition & automated transcription of lectures
- Why **lectures**?
  - Conversational, spontaneous, starts/stops
  - Different from broadcast news, other types of speech recognition
  - Specialized vocabularies

# Spoken Lecture Project

James Glass  
glass@mit.edu

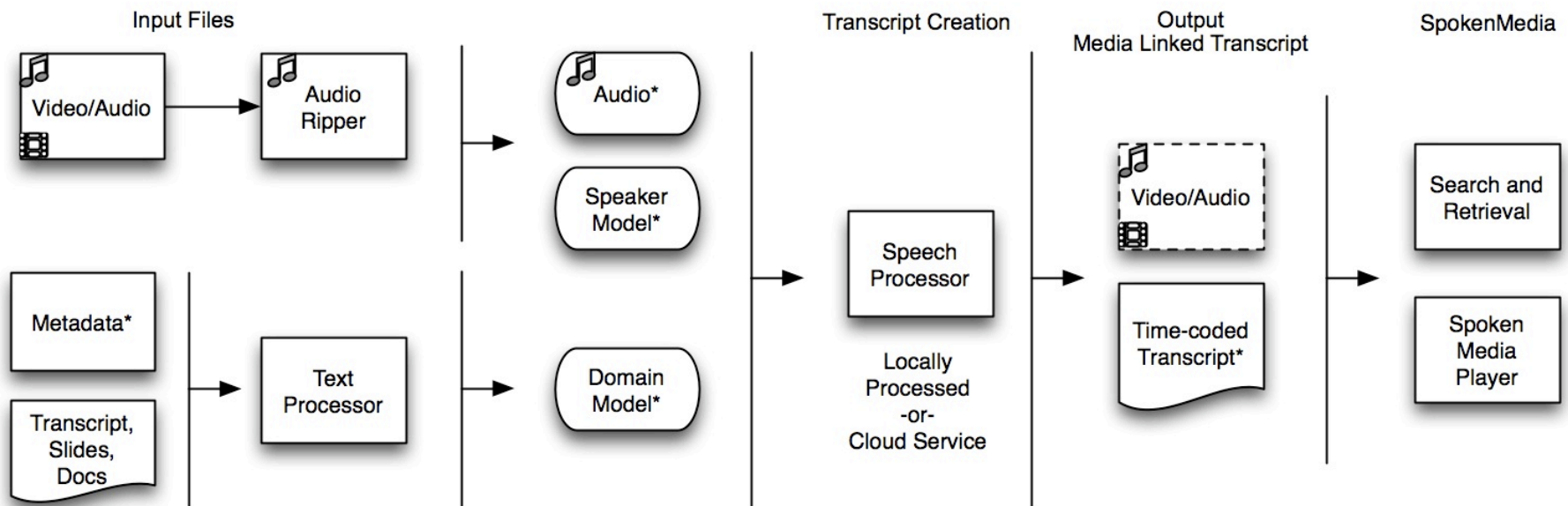


- **Processor, browser, workflow**
- Prototyped with lecture & seminar video
  - MIT OCW (~300 hours, lectures)
  - MIT World (~80 hours, seminar speakers)

Supported with iCampus MIT/Microsoft Alliance funding

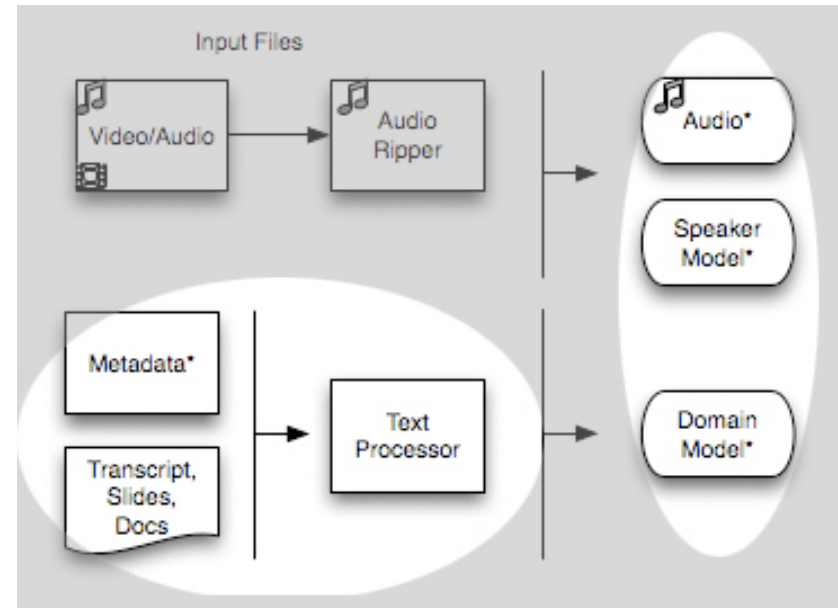
# How Does it Work?

## Lecture Transcription Workflow



# Recognizer Accuracy ~85%

- Accuracy
  - Domain Model and Speaker Model
  - Internal validity measure
  - Transcripts
- Ongoing research by Jim Glass and his team





# Transcript “Errors”

- “angular momentum and forks it’s extremely non intuitive”



- “folks”?
- “torques”?

- “introduce both fork an angular momentum”



- “torque”!

.....

we're now answering the part of eight oh one which is the most difficult for students and faculty alike ... we are going to enter the domain of **angular momentum** and forks it's extremely non intuitive ... the good news however is that b will stay with this concept for at least four five lectures today i will introduce both fork an **angular momentum** ... what is **angular momentum** if an object has a mass  $m$  ... and it has a velocity  $v$  ... then clearly it has a **momentum** ...  $v$  that's very well defined your reference frame the product of  $m$  and  $v$  ... thank the **momentum** ... i can take relative to any point i choose i choose this point  $q$  arbitrary ... this now ... is the position vector which i call our of  $q$  ... but this angle buffet to ... an **angular** **momentum** relative to that point is the vector ...

# That's what we have today...

- Features
  - **Search** and playback
  - Segmentation of video (concept chunking)
  - Bouncing Ball follow along
  - Randomized access
- Challenges
  - Accuracy ~85%
  - Transcript errors

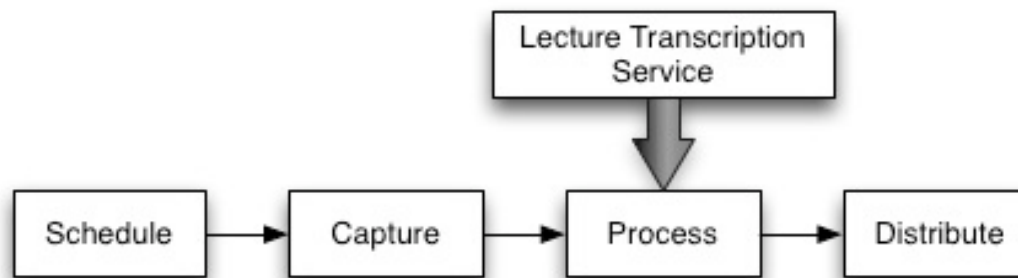
# Where are we heading?

- Transition to a **lecture transcription service**
- Toward **Rich Media Notebooks** to improve the user experience via Web 2.0 video interaction methods

# Transition: Research to Production

## A Lecture Transcription Service

- Prototype **transcript production** service
  - At MIT, University of Queensland
  - Automate processes
  - Integrate with media production workflows



- Engage with **content** (video) producers to **test**
  - UC Berkeley, Harvard, etc.
  - Opencast Matterhorn



# A Lecture Transcription Service?

## Caveats

- Lecture-style content (technology optimized)
- Approximately 85% accuracy (probably not a full accessibility solution)
- Other languages? (not sure)
- Processing hosted at MIT (current thinking)
  - So will submit jobs via MIT-run service
  - Contribute audio extract, models, transcript for further research

# Toward Rich Media Notebooks

## Improving the User Experience

- Upgrade playback (Flash, H.264 encoding)
- Innovative interfaces
  - Bookmarking and annotation
  - Clip creation and authoring
- Social Editing (improve transcripts)
- Concept and semantic searching
  - Semi-automated creation of concept vocabularies

# Alternate Representations

- Microsoft Project Tuva: Enhanced Video Player
  - [research.microsoft.com/apps/tools/tuva/](http://research.microsoft.com/apps/tools/tuva/)
- MIT OCW Highlights for High School
- Look Listen Learn
  - Alternate view of MIT OCW video
  - [www.looklistenlearn.info/math/mit/](http://www.looklistenlearn.info/math/mit/)
- Google Audio Indexing
  - [labs.google.com/gaudi](http://labs.google.com/gaudi)
  - U.S. political coverage (2008 Elections, CSPAN)

## Richard Feynman: The Messenger Series: The Great Conservation Principles

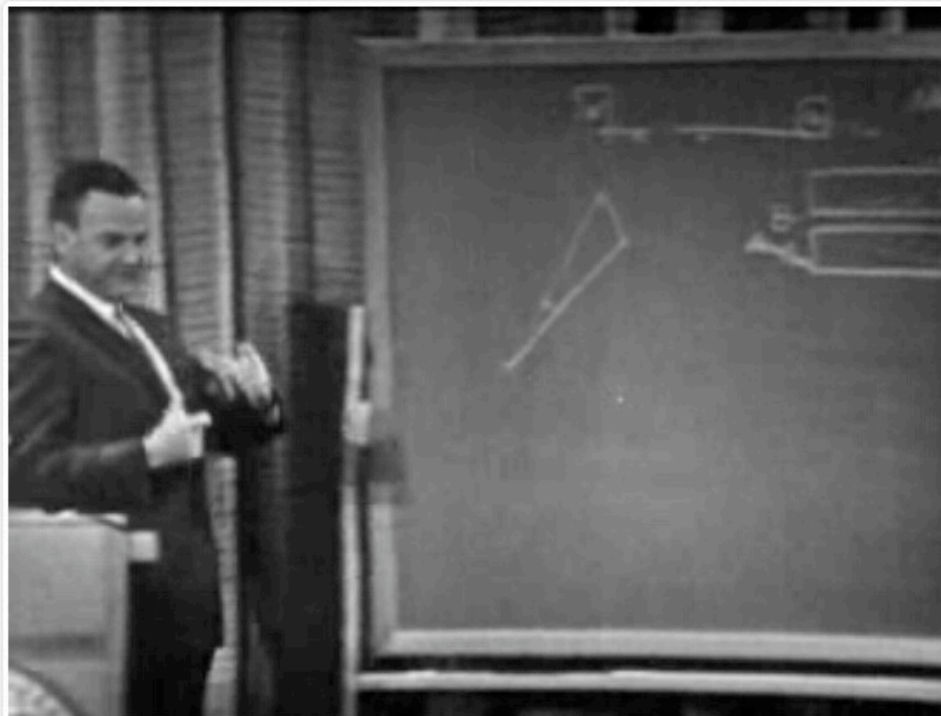
NOTES | 1

44:31

Here Feynman covers Angular Momentum

Insert Note at: 45:47

0 / 150



The explanation is, that angular momentum appears in two forms:

45:47

2

3

4

5

6

7

8

9

10

11

12

56:03

Notes

[research.microsoft.com/apps/tools/tuva/](http://research.microsoft.com/apps/tools/tuva/)

Credits: Contributors | Stimulant



# MIT OCW

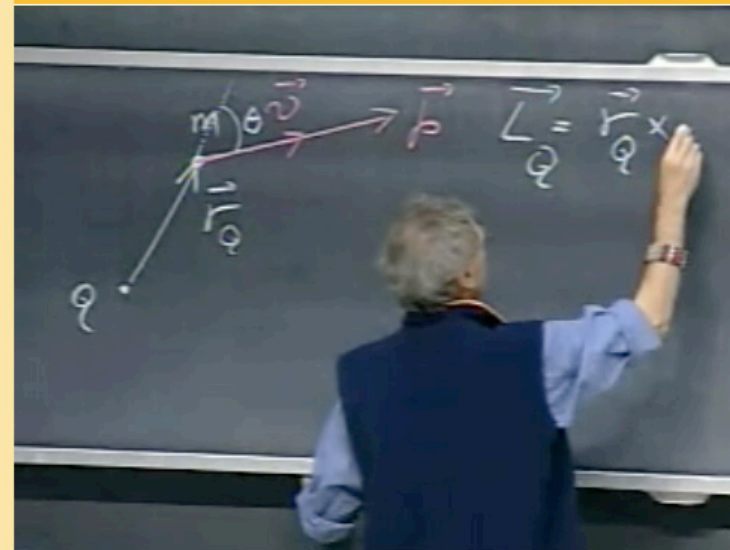
## Highlights for High School

### Lecture 20 - 8.01, Physics I

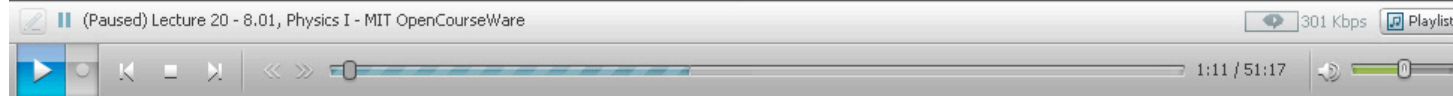
Choose your topic below for Lecture 20:

- > Angular Momentum (0:00)
- > Conservation of Angular Momentum (8:18)
- > Ice Skaters' Delight (17:36)
- > Stellar Equilibrium and Remnants (25:34)
- > Stellar Observation (35:32)
- > Supernova Images (40:54)

Now playing:  
Angular Momentum



MITOPENCOURSEWARE  
MASSACHUSETTS INSTITUTE OF TECHNOLOGY



<http://ocw.mit.edu/ans7870/hs/physics/8.01/8.01-f99-vl20.ram>

It's a relation between  $x$ ,  $y$ ,  $z$ , and  $f$ .

13 English

**Lecture 11. Differentials**

- MIT
- ▼ Differentials
  - Single variable differentials
  - Total differential**
  - Chain Rule
  - Example
- ▼ Applications of chain rule
  - Product and quotient formulas
  - Chain rule with more variables
  - Example: polar coordinates

**Total Differential**  $f(x, y, z)$

$$df = f_x dx + f_y dy + f_z dz$$

$$df = \frac{\partial f}{\partial x} dx + \frac{\partial f}{\partial y} dy + \frac{\partial f}{\partial z} dz$$

**Important:**  $df$  is NOT  $\Delta f$

Can do:

1. Encode how changes in  $x, y, z$  affect  $f$

2. Placeholder for small variations  $\Delta x, \Delta y, \Delta z$  to get approx formula  
 $\Delta f \approx f_x \Delta x + f_y \Delta y + f_z \Delta z$

[www.looklistenlearn.info/math/mit/](http://www.looklistenlearn.info/math/mit/)

## Audio Indexing

All Politicians | [McCain](#) | [Obama](#) | [Debates](#)



[Bernanke Hearing The State of Our Economy](#)

1 week ago - 05:53 - about 2 mentions



[Presidential Press Conference Opening Remarks](#)

1 week ago - 08:01 - about 4 mentions



[How We Can Turn Our Economy Around](#)

4 months ago - 05:32 - about 9 mentions



[Senator Boxer on Hilda Solis & the Economy](#)

5 months ago - 18:00 - about 7 mentions



[American Dream with Cynthia McKinney GM Bankruptcy PT1](#)

1 month ago - 10:01 - about 5 mentions



[American Dream with Cynthia McKinney GM Bankruptcy PT2](#)

1 month ago - 09:39 - about 5 mentions



[CNN Obama 100 Days Press Conference](#)

3 months ago - 06:14 - about 5 mentions



[The Democrat Mega Spending Package](#)

5 months ago - 06:18 - about 8 mentions



[President Obama First Prime Time Press Conference](#)

5 months ago - 07:26 - about 5 mentions



[Roskam Discusses Healthcare Reform on NBC Chicago Nightly News](#)

1 week ago - 01:43 - about 2 mentions

## How We Can Turn Our Economy Around



economy

Search inside this video



...I rise today to talk about America **economy** and we're Americans are out right now we've seen a...



...the that way we can turn this American **economy** around next quarter we...



...about where they're going to go in this **economy** and we can we know...



...we need to get people to invest in the **economy** and you do that fight...

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URL

<http://labs.google.com/gaudi?q=economy&longId=6227534966156070>

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# Thanks!

## [oeit.mit.edu/spokenmedia](http://oeit.mit.edu/spokenmedia)

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